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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

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Forthcoming Events.

SEPTEMBER 4-7.
Institute of Metals:—Annual autumn meeting at Liverpool.

SEPTEMBER 5-12.
British Association for the Advancement of Science:—Meeting at Glasgow.

SEPTEMBER 22-27.
Iron and Steel Institute:—Autumn meeting at Bilbao.

SEPTEMBER 5-22.
Machine Tool and Engineering Exhibition at the Olympia, London.

Converging Lines of Defence.

Those who read Mr. Shaw's Paper on "Theory or Practice in the Grey Iron Foundry" will agree that the contributions to the discussion made by various eminent metallurgists show it to be a Paper of considerable importance; and it is, as we have previously hinted, somewhat surprising that his views should secure such support from those whose interests are mainly considered to be identified with academic research.

We are also a little surprised to find one or two scientists, such for instance as Professor Piwowarsky, considering Mr. Shaw's criticism somewhat strong. It is usually the other way about, the practical man as a rule being inclined to consider criticism of Papers by scientific men as too severe and too sweeping. As a matter of fact, of course, the ordinary scientific worker thinks that his work does not achieve its full value until it is published with the very object of securing that discussion and criticism which it gets after publication. The more searching the criticism, provided it be based on reasoned grounds, he thinks, the greater the benefit to science as a whole and to the reader of the original Paper. Scientific workers are therefore accustomed to give and take hard knocks in discussion and to expect them and treat them as matters of course when they come. The practical man usually produces his Paper after rather more effort, and frequently with much more difficulty in the way of presentation and publication, and is inclined to regard criticism as personal, whereas it is usually nothing of the kind. To have the scientific worker, therefore, complaining that practical criticism might injure research work by discouraging and disheartening the research worker is rather novel.

We do not, however, share the view implicit in the remarks of Prof. Piwowarsky and Dr. Hatfield that there was any intention of criticising or belittling the work of the pure scientist. We should regret any such conclusion because no worker follows more closely, or with keener interest, the work of the pure metallurgist than the author.

We conclude after perusing the discussion closely that the surest line of advance lies along both avenues, and that the two avenues will ultimately converge to the same goal. The main moral of Mr. Shaw's Paper is that research on such a complex aggregate as cast iron requires to be put on a thoroughly systematic basis, and half a dozen men working in a team with one policy and one plan will get farther than half a hundred men working separately, each following his own particular idea. In the one case the conditions get very carefully determined and controlled, in the other case, however carefully conditions are recorded, they will differ from station to station, with the result that the uncertainty of the operation of unknown factors tends to upset the conclusions drawn. This, of course, does not discourage the individual investigator; rather, does it point to the individual investigator choosing his problem so that it helps the general plan.

We therefore think that Mr. Shaw's Paper has served an extremely useful purpose in stressing the need for systematic investigation on cast iron as we know it, rather than on the synthetic aggregate made in the laboratory. Work is required, and will probably continue to be done on both lines, and they will ultimately converge to the same goal. Obviously, if we understood everything about cast iron we should know the reasons for the differences between the behaviour of the commercial material and that of the synthetic aggregate, which resembles it only in chemical analysis. We think that academic workers as a whole will see it in this light, and will not regard the Paper in any sense critical of their efforts.

Playing Second Fiddle.

The welding industry has undoubtedly been making great headway, and apparently has been successful in orienting the views of some leaders of industry to such a magnitude that Mr. Rugg, vice-president of the General Electric Company (of America) has thought it wise to warn both the riveting and foundry trades of the severity of the competition soon to be imposed. As an instance the construction of small motors is cited. This warning, emanating as it does from such an important authority, cannot lightly be dismissed, but at least one founder we know will be delighted at the news—he casts the welding rods. Then, of course, such a development will consume more steel and the founders casting ingot moulds, furnace parts, rolls and rolling-mill parts and spares will not grumble. The foundry industry is so elastic, and caters for every industry, that it can always view the future with equanimity. Again, it can never be assumed that the foundry has reached the limit of either its production increase or its cost-price decrease. We are not at all convinced that if a foundry was specially created to produce small motor castings carrying only overheads appertaining to that production, and mechanically equipped for rational work, that it could not manufacture the goods more cheaply than by the welding of pressed sheets. The shops destined to carry out the newer process will most probably be excellently equipped, brilliantly lighted and ventilated, and admirably organised, and the results obtained will be compared with those derived from working in an indifferently equipped, badly lighted and financially starved department devastated by tradition. We wish it to be clearly understood that this constitutes no imputation against the management of any foundries connected with the electrical engineering industry, as it is well-known that so far as Great Britain is concerned they rank amongst the best in the land, but rather is it a reminder that the "big noises" in the engineering industry in general have not, and do not, take sufficient interest in the potentialities of the foundry end of their business. When trade is bad some of them, unthinkingly, devastate the industry as a whole by filling their foundry at cut prices with jobs not legitimately or normally their business.

Thus the moral to be derived from the forthcoming competition from welding is that no matter how severe or revolutionary the change, those sponsoring it will still be dependent on the foundry industry, and the latter, on account of its elasticity, can by encouragement—moral and financial—be induced to deliver very cheap and reliable goods at prices to be associated with the former.

XUM

Risers, their Need and Feed.*

By R. R. Clarke.

In the main, risers connect with castings for one or more of four distinct purposes:—(1) To relieve strain of hard pouring; (2) to circulate metal through the mould; (3) to entrap and hold dross from the casting, and (4) to feed the casting against shrinkage. Of these four functions this Paper is concerned with the last named only, and will deal with it exclusively.

The feeding riser is a moulding tribute to shrinkage or contraction. This contraction is a decrease in the volume of a metal body, mass remaining the same. It is a decreed and unescapable exaction and is common to all metals and alloys though not to the same degree in each. There is no absolutely non-shrinkable metal.

The need of a feeding riser is the outgrowth of a casting condition or set of conditions from which shrinkage derives an abnormal advantage.

Metal by Nature Heavy in Shrinkage.

All metals shrink but not all to the same degree. Copper 80, tin 10, lead 10, for instance, has far less shrinkage than copper 60, zinc 40. In different forms and volumes the latter will demand copious feeding, where the former may require none. Of those metals of high inherent shrinkage, pure copper is a common example. Among other metals and alloys, aluminium, aluminium-base alloys, nickel-silver, monel metal, "copper-aluminium alloys," and copper-high zinc alloys, are well known for their shrinking treachery and always are subjects of riser consideration. In the alloys containing lead as well as those where the zinc content is less prominent, the shrinkage reduces correspondingly and the riser situation becomes less critical. In illustration of high shrinking alloys we note manganese bronze, yellow brass aluminium bronze, and nickel-silver. Of those with less shrinkage we observe red brass (85-5-5-5), phosphor bronze (80-10-10), gun metal (88-10-2) and bell metal (copper 83¼, tin 16¾).

Exaggerated Natural Shrinkage.

This will occur often in poor grades of metal, especially in the base metal of an alloy, as in low-quality aluminium in the aluminium-base alloys and low-grade copper in the copper-base alloy. The "rawness" of an alloy derived from a high percentage of virgin metal used along with a low percentage of remelt metal is a further potent factor. All other factors being equal a heat of all new metal will far "outshrink" the same heat poured into a casting on second or third melting.

Semi-Fluid and Plastic Low Strength of Alloy.

Between a light and heavy section adjoining each other, a severe rupture or cleavage will occur by the "setting" strain in one metal or alloy and not in another. A fairly-high zinc, copper-base alloy with no lead compared to the same alloy with a fair addition of lead will serve to illustrate. In the one instance rupture will materialise; in the other it will not. The power of the lead to reduce the *quantity* of shrinkage is no doubt in part responsible. At the same time the author's conviction is that a raising of physical properties of the plastic mass by the lead is not without its just claims for credit.

Temperature Factors.

Cases exist where because of conflicting conditions the metal has to be poured above or below that temperature at which its shrinkage is least expressive. When poured cold, aluminium and its alloys shrink least. An aluminium casting containing heavy and light sections must be poured hot to run the light section which may necessitate a riser on the heavier section to overcome the greater shrinkage of the hotter pouring. Gun metal, on the other hand, expresses less shrinkage when poured hot than when poured cold. When it is desired to relieve some part of the mould of severe sand burning and the metal in bulk must be poured cold, a riser is often essential to control the greater shrinkage expressing.

Where the Casting Expresses Metal Bulk.

This condition sets up where the ratio of volume to surface is high. With a circular disc 8 ins. dia. by 1 in. thick, a single medium-sized pouring gate will hold it against localising shrinkage which it usually expresses in cope depression. The volume of this disc is practically 50 cub. ins. Its surface is 125 sq. ins. The ratio of volume to surface is as two to five and it cannot be said to be bulky. By increasing the thickness to two inches the volume increases to 100 cub. ins., the surface to 150 sq. ins. and the ratio becomes as 2 to 3. As the casting increases in bulk the cope surface will indicate a tendency to sink when poured with the same gate. Now if the thickness of the disc increases to 12 ins., the volume becomes 600 cub. ins., the surface 400 sq. ins., and the ratio of volume to surface as 3 to 2. In other words, the casting's volume is one and one-half times its surface. Here bulk is decisive and a full, solid casting throughout requires a feeding riser regardless of the metal or alloy used. Now, if we increase the 2-in. thick disc to a diameter of 24 ins., then the volume becomes 904 cub. ins., the surface 980 sq. ins., and the ratio almost one to one. Here bulk is moderately high and the distance from any one circumference pouring gate, regardless of its size, to the centre of the disc on to the extreme opposite point from this pouring gate is too great to be completely dominated by the gate feed. A casting of this size and shape will therefore give better promise if several feeding risers be placed equidistant on the circumference of the disc. A riser in the centre of the disc is another possibility. This centre riser, however, must be necessarily heavier than circumference risers in multiple and makes for a harder condition of removing the riser from the casting. Incidentally all figures increasing in dimensions advance in bulkiness. In a 2-in. cube volume to surface is as 1 to 3; in a 4-in. cube as 2 to 3; in a 6-in. as 1 to 1; in a 12-in. as 2 to 1.

Difficulties in Location.

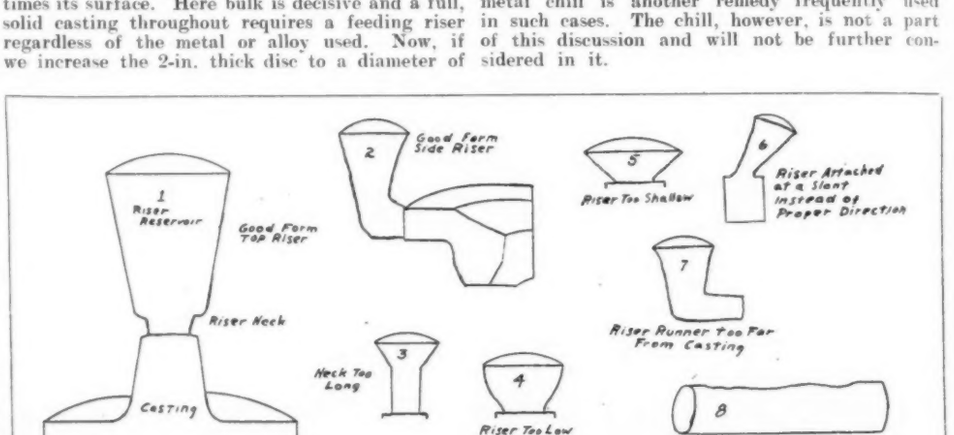
Other cases exist where the pouring gate is either impossible of placing at some required feeding point or functions better in the running of the casting at some other point than this required feeding point. The 8-in. diameter disc 1-in. thick will serve to illustrate. Suppose this disc to have a 3-in. diameter with a 3-in. high solid hub in its centre. The casting could be run either from the circumference or from the hub by a subterranean gate, but in neither case could it be always depended upon to control shrinkage in the hub. A feeding riser on the hub would be more assuring. Deep mould castings of bulk run from the bottom are further examples.

Solidity of Casting Metal of Prime Importance.

This occurs, for instance, in pressure castings. A bushing, 6 ins. dia. by 10 ins. long, with a 2-in. core will illustrate. If the bushing, of some low-shrinking alloy, be intended only to be cut into washers, the casting might be passed without feed, but if meant for a high-pressure cylinder liner, a feeding riser on the casting functions to give the greater required density of the metal.

Variables of Bulk Adjoining Each Other.

If a rather light, thin section joins a fairly heavy bulky section in a casting, the light thin section will solidify and exact its toll from the heavy section while this heavy section is yet fluid and in full possession of its liquid properties. Cleavage or rupture between the two sections is therefore a remote possibility because the fluid metal of the hub adjusts the loss at the overall expense of the hub. But if the two sections be nearly equal in bulk and freezing rate, then the pull of the one is exerted on the other in its viscous or plastic metal state and the toll taken cannot be so adjusted. It is then cleavage or rupture between the two sections occurs. In all such cases of bulk variables the feeding riser furnishes a promising solution. The metal chill is another remedy frequently used in such cases. The chill, however, is not a part of this discussion and will not be further considered in it.



Heavy Bulk High in the Cope of the Mould.

If we feed a casting section, from a feeding supply beneath that section, we have gravity against us. If the same section be fed, from a supply above, downward, gravity aids the process. Wherever bulk of prominence occurs above the point of gate supply, the feeding riser becomes a subject of consideration. Any casting section, it might be noted, can be fed upwards from a metal supply beneath it, but not with the same sized gates and gate pressure nor to the same advantage as feeding from above it.

Irregular Thermal Conditions in Varying Sections.

These variations occur mainly from delivering conditions in point of time and distance and have a decided effect on localising shrinkage. A solid disc with a moderate central hub on the under side will illustrate. If we gate on the rim the metal crosses to the hub, fills it and cools while the disc of the mould fills. The hub metal is therefore colder at pouring finish than the plate metal, which is a logical order and will obviate a riser under moderate conditions of hub bulk. Now if we gate with a horn gate on the hub from in under then the opposite of conditions attend the relative temperatures. Such conditions in an alloy of hot metal shrinkage may require a riser to overcome that shrinkage. Many occasions arise in moulding where similar conditions of relative temperatures make for or against the riser need.

* A Paper presented to the Philadelphia Meeting of the American Foundrymen's Association. The author is at the Alloy Foundry of the (American) General Electric Company, Erie.

Feeding Additional to the Pouring Gate Control.

Often the best pouring point of a casting is not the best feeding point. Frequently also a running gate cannot be sized to meet feeding requirements. An example occurs in a chunky casting at the opposite end of a long runner gate from the pouring sprue. Here a feed sprue is necessary to hold up the chunky casting.

Cores so Placed as to Cause Kick-back Disturbance.

A riser at such a point lends its weight to live immediate pressure to quell the disturbance and feeds back into vacancies caused by that disturbance after the core has terminated its activities. Many times the author has found that a riser at a certain point would dominate a core kick and its consequences, which frequently materialises when the riser is omitted.

Where a Gate Joins a Casting.

Unluckily, in many alloys of high shrinkage as in copper, high zinc-copper, etc., where a gate joins a casting, a bad gate pin-hole will often develop. A riser or bob set over the gate close to this juncture point will supply and deliver a feeding quota of metal and obviate the pin hole.

Four Requirements of a Feeding Riser.

The foregoing comprise the main necessities of the feeding riser and will be found to cover the majority of conditions expressing in one form or another. With its necessity understood the constructive principles of the riser will now be considered.

That any feeding riser may completely satisfy the demands of its dependent casting, four distinct requirements must be understood and served:—(1) The riser attaching surface must fully cover the zone of final concretion or solidification beyond or beneath it in the casting; (2) the riser volume must be ample for the shrinking loss; (3) the riser metal fluidity must be maintained to penetrate to the last the shrinking vacancy, and (4) the riser height must be sufficient for a pressure to force the feeding supply solidly into this vacancy.

Briefly, risers should be high, heavy and hot, and in direct and unbroken communication with the final shrinking loss. They should further be placed as close to this freezing zone, which is usually the centre of mass, in the casting, as conditions will permit.

Constructing a Feeding Riser.

In constructing a feeding riser the first consideration is to place it at the point of greatest advantage and to make the size of its attaching surface cover fully the zone of final loss. Every casting or casting section solidifies from all bounding surfaces inward to its centre of mass and draws on the immediate liquid metal of the casting to feed the inmoving freezing mass. In a sense the casting feeds itself automatically up to a certain depth of freezing metal but cannot so feed itself to its freezing heart. Safely to overstretch this final freezing zone is correctly to determine the area of the casting surface covered by the attaching riser.

The next step is to get a heavy supply of metal above this attaching surface, a supply that will keep its fluidity and continue feeding to the final freezing of the mass centre beneath or beyond it. To this end the riser neck must be not too long, never more than from ½ in. to 2 ins., and should enlarge at once therefrom into a reservoir form that holds a volume of metal immediately above it, this form increasing in dimensions upwards to its top. In this connection the bottle-neck riser as shown in Fig. 1 is the most efficient form of riser of which we know. Regarding the general form of riser, it might be remembered that the round form is the most bulky of all other practical forms and contains greater volume per surface than any other practical form. It is therefore a better feeder than the cubical, the hexagonal, and all other forms except the spherical, which is, of course, physically impossible in the open-top riser. A feeder attaching to the side of a casting should observe the same general principles as a top attaching riser. These principles are illustrated in Fig. 2. Bad forms of risers are noted in Fig. 3, 4, 5, 6, and 7.

Discussion of Results.

Metal flowing from the mould into a riser is essentially colder in the riser than in the casting, and will naturally freeze quicker bulk for bulk, which is the improper order for feeding. To attain the correct condition, riser bulk and volume should be predominating and temperature of metal raised by pouring hot metal directly into the riser whenever possible.

The power of a high-up pouring sprue or pressure gate to displace a riser on a bulky, low-shrinking metal casting was a disputed point at the Chicago (1927) convention of the American Foundrymen's Association. The case discussed was an eight-inch diameter by twelve-inch long solid cylinder moulded on end, gated at the bottom with a small gate, and poured of 80-10-10 metal, with no riser attached. At that time the author of this Paper questioned the complete solidly and calculated dimensions of a casting so poured. Examining the condition we find the volume to be 600 cub. ins.; surface 400 sq. ins., ratio of volume to surface 3 to 2, and the weight approximately 200 lbs. Here bulk is decisive and volume heavy. Moulded on the flat, this casting shrank as shown in Fig. 8, showing that heavy shrinkage is an inherent part of the metal in this form, *i.e., that the shrinkage is there.* To assume that the shrinkage suspends merely because the casting is poured on end is an absurdity. Moreover, of two such castings in the same mould and poured at the same instant from the same ladle, the one with a riser weighed two pounds more than the one without a riser. In a series of experiments so made the fed casting invariably outweighed the unfed by from two to three pounds.

Regarding the high gate pressure deriving from a high-up pouring head, it might be stated that this high gate pressure will invariably give a more full and solid casting up to certain limitations than a gate of lower pressure, but the fact cannot be overlooked that this pressure is fundamentally only a hydro-static pressure obeying the laws of a liquid and applying only during the tenure of fluidity in the gate. Once the gate at any point freezes back of the casting, pressure and feeding from the gate at once and alike stop in the casting. To pour from the bottom a heavy casting of this nature with a small runner gate means that when this gate freezes it severs all relations with the casting and leaves the casting, so far as the gate is concerned, absolutely self-supporting against shrinkage regardless of the gate height or pressure. Nothing in moulding is more foolish than a heavy bulk or high pressure of metal intended to feed a casting, and connecting to that casting by a channel that freezes tight long before the casting itself departs its liquid or plastic state.

HELLO! ARE YOU THERE?

The Telephone Number of THE FOUNDRY TRADE JOURNAL *will be changed as from* 1.30 *p.m. on September* 1 *from Gerrard* 3951 *to Temple Bar* 3951 (4 *lines*).

Publications Received.

Tin.—The monthly Bulletin of the Anglo-Oriental Mining Corporation, Limited.

The hundreds of non-ferrous foundries in this country will welcome this new publication as an instrument providing pointers for their tin-buying programme. Its statistical charts are clearly set out, whilst the general presentation gives one the impression that the publication is designed to enlighten interested people in tin, and not tin company shares, as has so often been the case in the past. The issuing company are extremely important manufacturers of metallic tin at their splendidly-equipped works at Bootle.

Random Shots.

I was interested a few days ago to note the finding, through some excavations, of a wooden water pipe, about 400 years old. It was 18 in. in diameter with a 3½-in. bore. I should imagine that a modern cast iron pipe could be made with a relatively infinitely smaller amount of labour, and we can scarcely imagine civilisation back at the point at which it would be necessary to hollow out water pipes by hand from tree trunks. Yet this has an important bearing on an interesting point raised in the provincial Press a few days ago. I noticed that in a general discussion which was going on relating to unemployment, over-production and various other matters, a correspondent signing himself "Foundry Worker," suggested that the present unemployment problem was due to the quickening of production, owing to the introduction of machinery, which enabled the same amount of goods to be turned out with a smaller amount of labour. He thought that if this process could be stopped, the absorption of the unemployed would be facilitated.

* * *

This old economic fallacy raises its head periodically, and it has been said that it is responsible, more than anything else, for the "ca-canny" attitude found among workmen. It is, of course, only an economic truth to say the reverse is, in fact, the case. Quickening of production (*i.e.*, speeding-up men or machines or using better machines) means ultimately cheapening of production, which results in increased demand due to the lower prices, which means absorbing the labour originally displaced by the introduction of machinery. Our economic life to-day, in fact, would be impossible without the machine. Transport is inconceivable, for example, without the internal-combustion engine. There is much truth in the suggestion that our present industrial troubles are due, not to too much machinery, but to too little, and that prices can only be brought down by the increased application of machinery. This is certainly true of the United States, where the increase in the national wealth began to take place at a greater rate than in this country, when Americans first learned their gospel of the lavish use of mechanical power.

* * *

The fact is that we live by taking in each other's washing and one man is a producer because hundreds of other men are consumers. The re-absorption of the unemployed will be brought about mainly by an increase in purchasing power on the part of the consuming public as a whole, which largely consists of wage-earners. The consumption of goods will mainly be stimulated by a lowering in selling price, which means a lowering in production costs. This in turn will be brought about, not by the use of less, but by the use of more machinery. I always think that a balance has to be maintained in anybody's income in spending on consumable goods and saving which mainly goes as bank loans to industry, to stimulate the production of machinery, which in its turn facilitates the production of other consumable goods. Before the war, English people, as a whole, probably saved a little too much and did not have high standards of living, so far as consumable goods are concerned. Now the pendulum has swung too far the other way, and we spend too much on consumables, whence arises the prosperity of the breweries, food manufacturers, tobacco manufacturers and cinemas, while we save too little, with the result that capital has to be bought at a fairly high rate of interest, and the basic industries mainly producing machinery find it difficult to make the necessary margin of profit.

* * *

Heard over the back fence: "Yus, Mrs. Harris, my 'usband allus presses 'is trousers under the mattress, 'im being such a 'eavy sleeper."

* * *

Now that the advance copies of the papers to be read to next week's meeting of the Institute of Metals are available, it is clear that from the foundry viewpoint it is to be a "worth while" occasion, as a wealth of matter appertaining to die casting is to be presented.

MARKSMAN.

German Ironfounders' Employers' Federation.

Third Day—Presidential Address.

On the third and last day of the congress was held the General Meeting proper, when the chairman, Dr. Ing. Werner, of Düsseldorf, presented the report of the Federation's activities. We reproduce below the main points of his remarks.

The number of insured workers had undergone a not inconsiderable increase, although under the influence of the general rationalising and labour-saving measures the number of men employed in the ironfoundries—as with all types of works—showed, for the same output of the foundries, a general declining tendency.

During the past year the Federation had again been able to provide considerable sums for the assistance of Technical High schools and Institutes, as also of students in the foundry branch.

The practice hitherto followed by the Federation of taking up general economic questions only in collaboration with the other large associations interested, thus saving unnecessary duplication of work, had been adhered to.

Particular attention should be paid to the work of the Committee set up by Act of Parliament to investigate into conditions of production and sales in German industry. Business for the foundries had been much facilitated by more favourable treatment of their products in respect to railway rates.

The Eight-Hour Day.

The Federation had been more and more occupied in the last few years with the questions of agreements and working hours in the foundries. The trade unions' policy had been to endeavour to make the eight-hour working day the rule in the foundries, as in all other works, without any consideration of the fact that, in foundries, the completion of work was chiefly dependent on the running of the melting furnaces.

Speaking of prices being raised, Dr. Werner stated that, in connection with these increases, it had been repeatedly urged in criticism of the foundries that they, as much as any other branch of industry, were under the duty of rationalising their works. The Federation could say with a clear conscience that they on their part had done everything possible, through both scientific and technical work, to smooth the way for the foundries of the country to carry out all necessary rationalisation measures.

To a particularly great extent had the Federation applied itself to the training of the rising generation of foundry workers and a recruiting pamphlet entitled, "Shall I Become a Moulder?" had been distributed in large numbers. A committee of well-known experts had been formed in order to devise simple but reliable tests by which suitable apprentices could be chosen. The school education of the apprentices still left a great deal to be desired—especially did the question of teachers or instructors call for the Federation's attention. At the latter's instigation, the training college for industrial teachers in Cologne had instituted a special course for those trade school teachers who would have charge of classes in moulding and pattern making.

The Industrial Standards Committee for the foundry trade had, in the year under review, been particularly active. The moulding sand investigations had been further continued and, in the case of the moulding sands of Southern Germany, could be considered as well nigh completed.

Growth of Cast Iron.

With regard to the further problems upon which the Federation had been working for a number of years, it could be reported that the investigations of their committee dealing with the growth of grey cast iron at high temperatures had, for the present, come to a conclusion. The next task for the committee would be the study of the influence of vibration upon the growth of cast iron. A new committee had been created to carry out work on pig-iron.

The study and rationalisation of cupola installations remained the leading task of the Giesserei-Beratung-G.m.b.H. (Foundry Advisory Association, Limited). As a distinguished institution, the association had always regarded it as one of its main activities to examine all new processes and methods put forward with regard to their practicability and utility.

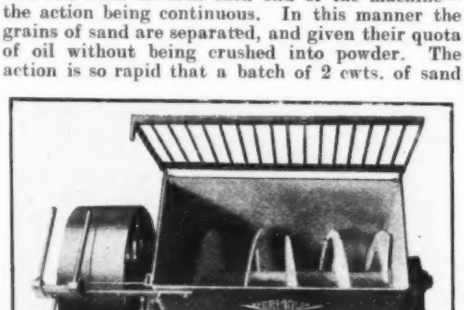
German Foundry Trades Exhibition.

The results of all these technical investigations, continued the chairman, would be made public upon the occasion of the Foundry Trades Exhibition to be held, under the slogan, "Economic Foundry Work," in the summer of 1929. This exhibition was being organised, in conjunction with the Verein deutscher Giessereifachleute (German Foundrymen's Association), and by agreement with the foundry associations of other countries as represented by the international committee, to correspond with the occasion of next year's big International Foundry Congress in London. In this way, the foundry specialists of the whole world, especially of America, would have the opportunity of visiting the Exhibition upon leaving the congress.

The Materials Congress, with its section on cast iron, held last autumn in Berlin, had been most successful in showing the world that the German products had to fear no foreign competition. If now, said Dr. Werner, they had the opportunity, at their exhibition next year, of showing, besides the quality of the products of the German foundry trade, the methods also by which the materials best suited for each particular use are manufactured at minimum cost, it would give a good general picture of the present state of the German foundry industry.

A New Sand Mixing Machine.

Messrs. Spermolin, Limited, of Black Swan Works, Halifax, have designed and placed on the market a new type of oil and sand mixer based on Richards' Patent. In this machine the sand is rotated and conveyed to the centre by right- and left-handed scrolls, working on a common shaft. This causes an intensive rubbing together of the sand grains, which are thrown up in the centre, and fall back towards each end of the machine—the action being continuous. In this manner the grains of sand are separated, and given their quota of oil without being crushed into powder. The action is so rapid that a batch of 2 cwts. of sand and oil can be thoroughly mixed in three minutes.



The Spermolin Oil Sand Mixer.

The discharging arrangement is simple, tilting being superseded by an oblong damper in the centre of the pan bottom, which is operated from one end of the machine. The sand is discharged automatically into a conveyor or barrow.

As shown in our illustration, a safety grid is fitted, and with this is incorporated an ingenious locking device, which makes it impossible to start the machine until the grid is in the "closed" position. This remains locked until the machine is at rest, thus rendering it absolutely safe and fool-proof. The machine is of robust construction and of high-grade finish, and is covered by letters patent.

The machine occupies 4 ft. 6 in. by 2 ft. of floor space and is 3 ft. high. It holds 8 bucketsful (2 cwts.), and requires 3 horse-power. Of robust construction and high-grade finish, the machine can be relied upon to respond to the arduous duties associated with the foundry.

Arc Welding Supplanting Castings.

Mr. W. S. Rugg, Vice-President, Westinghouse Electric and Manufacturing Company, in a statement announcing the near completion of the largest arc-welding shop in the world, insisted that his company had made such progress in various applications of arc welding to industry that it may be freely predicted that the riveting shop and the foundry are due for some serious competition from welding processes. The riveting process will probably be supplanted largely by arc welding, while a large part of the machine parts made by foundries will in the future consist of built-up welded shapes.

The progress which has been made in the arc welding of various types of structures is strikingly demonstrated in a review of Westinghouse applications of the new method of steel erection. Within a comparatively brief period they have erected by the arc-welding process two buildings in their Sharon, Pa., works; one building in their Derry, Pa., works; seven buildings in their East Pittsburgh, Pa., headquarters; a bridge 55 ft. long at Turtle Creek, Pa.; and a bridge 175 ft. long at Chicopee Falls, Mass.

The entrance of arc welding into the machinery fabrication field is given impetus by the new Westinghouse arc-welding laboratory, according to Mr. Rugg. This structure will be 75 ft. wide, 170 ft. long, and 40 ft. high. The structure houses a 50-ton crane, and in addition to the installation of arc-welding equipment, it will have massive rolling and forming equipment, to be used for forming and shaping the various parts that go into welded machinery. These included motor frames, generator frames, motor rotor rims, and motor end bells.

Mr. Rugg exempts only two classes of structures from the inroads of arc welding. Those structures for which a fabricated-steel construction cannot be justified are small pieces built in great quantities, such as the frames and brackets of small-diameter motors, and structures of such peculiar shape that they are not readily made from such commercial shapes of steel as bars, beams and plates.

A list of the products Westinghouse expects to weld in the future includes turbine generator frames, locomotive frames, synchronous motor frames and spiders, boxes, machinery bases, floor plates and tanks, miscellaneous machinery parts, industrial heating apparatus, steel pipes, and shop furniture.

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Analytical Discrepancies.

To the Editor of The Foundry Trades Journal.

Sir,—Referring to your "Notes on the Routine Analysis of Cast Irons and Iron Foundry Raw Materials, No. 1," the author has drawn attention to the fact that disagreements between analysts often occur when the amount of silicon present is being estimated. The taking of the sample is of immense importance, and the method given is possibly the cause of much disagreement.

The cleaning of the surface of a pig or casting is common practice, but we have found that it is essential to employ magnetic separation of the sample after crushing and sieving, since particles of sand are very often found, and they probably come from the interior of the object being sampled.

Yours, etc.,

For Sheffield Metallurgical Laboratories,
M. Stokes, Manager.

Staniforth Road, Sheffield.

August 24, 1928.

[Assuming a definitely clean surface, it is obvious that magnetic separation will reduce "apparent" error arising from the presence of sand, yet we submit that it is bad practice on the following grounds:—(1) Graphite being non-magnetic will be left behind, and a low total-carbon and graphitic-carbon content will be returned; and (2) if the sand is in the interior of the casting it should be returned as silicon, just as manganese sulphide, the phosphorus eutectic and other constituents are translated into the elemental state for ready appreciation.—Editor.]

Notes on the Routine Analysis of Cast Irons and Iron Foundry Raw Materials—No. 3.

(*Continued from page* 137.)

By Arthur Smith, M.A.

Estimation of Sulphur.

Sulphur usually occurs in cast-irons, pig-irons and ferro-alloys as sulphides of iron and manganese, and as far as steel is concerned there are two distinct types of methods, viz., (1) oxidation-gravimetric method—with HNO_3 and estimation as $BaSO_4$, or (2) volumetric method—evolution as H_2S and absorption in various alkaline reagents, followed by titration with iodine. In the case of normal low-carbon steels the amount of sulphur not evolved as hydrogen sulphide is probably of little account, and the method is quite as accurate as the total oxidation method, but in the case of cast irons the method gives consistently low results. The direct oxidation methods are of necessity slow, but they can be relied on to give the total sulphur present in any given sample of cast iron. In the case of low-silicon as well as high-sulphur cast irons the sulphur does not appear to be evolved entirely as H_2S, but partly as volatile carbon compounds, which latter is lost. Thus, it is essential that some variety of the total oxidation method should be used for the routine analysis of all cast irons and similar materials.

Procedure for Gravimetric Method for Sulphur Solutions Required.—(1) 10 per cent. barium chloride. Dissolve 100 gms. of barium chloride in distilled water, and make up to a litre; (2) Hydrochloric acid wash. Dissolve 10 gms. of barium chloride in a little distilled water, add 80 c.c.s. hydrochloric acid and dilute to 1,000 c.c.s.

Details of Standard Method.—Weigh out 5 gms. sample for all ordinary cast irons and transfer to a 600 c.c. beaker. Dissolve in 70 c.c.s. concentrated HNO_3. Add the acid carefully and gradually as the reaction is a violent one. Cover with a clock glass and warm gently on a hot plate till solution is complete. Then add 5 c.c.s. concentrated hydrochloric acid along with 0.5 gms. potassium chlorate or 2 gms. potassium nitrate as preferred to ensure oxidation of the sulphur compounds. Remove cover and evaporate to dryness and bake. Dissolve in 35 c.c.s. concentrated hydrochloric acid, evaporate to dryness again to destroy completely the nitrates. Pick up with 10 c.c.s. concentrated hydrochloric acid and 50 c.c.s. water, warming until all iron salts are in solution. Filter, using Whatman No. 31 or similar paper, and wash well with hot distilled water. The total volume of solution should be about 350 c.c.s. Heat to boiling and add 20 c.c.s. of 10 per cent. barium chloride solution, the addition being made slowly and with constant stirring of the liquid. Leave the solution to stand for at least 4 hours to allow the precipitate to settle, and then filter through a close-textured ashless filter, such as Whatman No. 44. First wash the precipitate on the filter with 20 to 25 c.c.s. of the special wash given above to remove iron salts, and finally wash very thoroughly with cold distilled water till free from chlorides. (Test with silver nitrate.) Ignite the residue in a weighed platinum or other suitable crucible. Add 2 drops sulphuric acid (1: 3), and again ignite. Weigh as barium sulphate which contains 13.734 per cent. sulphur. The barium sulphate obtained should be pure white in colour.

Precautions.—It is necessary to run two blank estimations on each batch of sulphurs. This is most conveniently done by running duplicates of two of the samples, using just double the quantity of each reagent. The blank obtained must be deducted from the weight of barium sulphate found for each sample. In order that this blank may be as low as possible, it is necessary to check the purity of all reagents used, and to use only those reagents which are sufficiently pure to be used as analytical reagents for sulphur estimations.

In the case of pig-irons and cast irons containing less than 0.04 per cent. sulphur, the author would advise the use of 10-gm. samples, with a corresponding increase in the quantities of reagents used. Also it will be necessary to allow the barium sulphate precipitates from such samples to stand for at least eight hours before filtration.

As barium sulphate is rather soluble in hydrochloric acid, even in cold dilute solutions, it is necessary to use this acid very sparingly in washing the precipitate; hence the adoption of the dilute acid wash containing barium chloride.

If the barium sulphate obtained is not perfectly white, it may be fused with sulphate-free sodium carbonate, and the sodium sulphate solution obtained from the melt after filtration from the barium carbonate, acidulated and the sulphur reprecipitated with barium chloride. It will only be necessary to wash with distilled water on this occasion, and then ignite the barium sulphate as before. However, for commercial work, if the process is carried out according to schedule this purification will be unnecessary. Some authorities prefer to precipitate the barium sulphate in the cold, but any advantage likely to accrue is offset by the unsuitable physical condition of the precipitate. Inaccuracy is much more likely to arise from solution of the barium sulphate during washing unless the details are carefully adhered to. The washing solution given will prevent any barium sulphate being dissolved. Where the utmost accuracy is desired, the main filtrate from the barium sulphate may be discarded, and the washings collected and evaporated to dryness. The resulting residue (if any) may then be dissolved in the smallest possible quantity of hydrochloric acid (about 1 to 2 c.c.s.) diluted with distilled water and treated with barium chloride. The resulting precipitate (if any) after washing is added to the main residue for ignition.

Direct solution of the sample in hydrochloric acid must be avoided else sulphur compounds will be evolved in the gases, and for the same reason it is necessary to use a large excess of concentrated HNO_3 (*i.e.*, 70 c.c.s. for a 5-gm. sample). In ordinary commercial work it is seldom necessary to examine the silicious residue for insoluble sulphur. For cast irons the accuracy of the above method should be such that the greatest difference between different estimations from the same sample should be within the limits $\pm$ 0.005 per cent. for normal samples, and $\pm$ 0.003 per cent. for the lowest sulphur contents up to $\pm$ 0.01 for sulphur contents over 0.15 per cent.

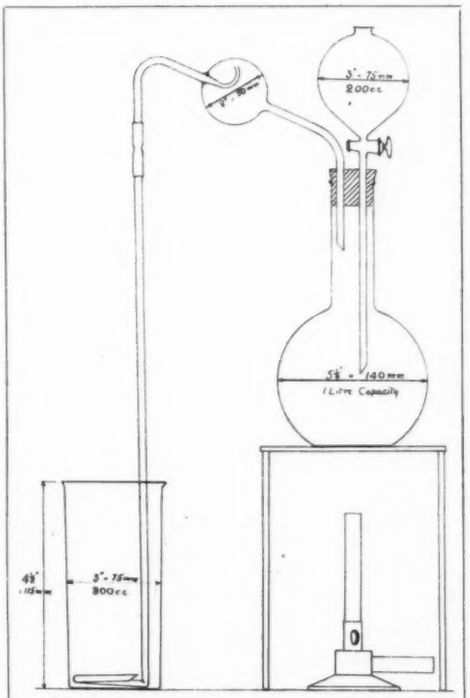


FIG. 3.—APPARATUS FOR THE VOLUMETRIC ESTIMATION OF SILICON.

Alternative Volumetric Method for Sulphur.

Where speed is essential then some form of the evolution method must be used, but accuracy suffers, as invariably low results are obtained on cast irons, especially with cast irons containing over 0.12 per cent. sulphur. High-sulphur cast iron standard samples are difficult to obtain, but a convenient method is to estimate carefully the sulphur by the gravimetric method in a high-sulphur cast iron specially cast so as to minimise segregation, and then standardise the volumetric solution against that sample, neglecting both the solution's theoretical and actual sulphur equivalent. In this way a solution of iodine could be given different factors for different ranges of sulphur in cast iron by being checked against standard cast irons of low, medium and high sulphur content. The author has found this scheme very convenient for work required in a hurry, the accuracy of which can later be checked by gravimetric oxidation method if considered necessary, especially when dealing with grey cast irons with sulphur in the neighbourhood of 0.14 to 0.22 per cent.

The method used is the straight-evolution method, the sample being dissolved in an excess of hot concentrated hydrochloric acid (sp. gr. 1.20), and the H_2S evolved is absorbed in ammoniacal zinc sulphate. The apparatus used is that shown at Fig. 3. The solutions required are as follows:—

Standard Iodine Solution.—Dissolve 1 gm. of pure iodine in 25 c.c.s. of water in which 10 gms. of potassium iodide has been previously dissolved. When solution is complete dilute to a litre, and subsequently standardise against the necessary standard cast irons.

Ammoniacal Zinc Sulphate Solution.—Dissolve 50 gms. zinc sulphate in 1,000 c.c.s. distilled water and add an equal volume of 0.88 ammonium hydrate.

Starch Solution.—Take 1 gm. Lintner's soluble starch and make it into a cream with 15 c.c.s. of cold distilled water in a small beaker and pour this into 200 c.c.s. of boiling distilled water. Use when cold and make up fresh for each batch of samples.

Details of Method.

A 5 gms. sample is placed in a conical flask and 100 c.c.s. hot concentrated hydrochloric acid is added by way of the funnel. The absorption beaker is filled with ammoniacal zinc sulphate solution. Rapid solution of the sample is desirable. If possible it is arranged that a current of hydrogen (sulphur free) is passed through the apparatus after solution is complete so as to clear out the remaining hydrogen sulphide. However, if the evolution is carried out rapidly, the hot gaseous hydrochloric acid and steam will clear out all the H_2S evolved. Indeed, the most important point is to make the evolution as rapid as possible. Concentrated acid is preferred, as with diluted acid more sulphur is liable to be left in the residue. The estimation of the precipitated zinc sulphide is carried out as follows:—Sufficient hydrochloric acid (1: 1) is run slowly down the side of the large absorption beaker so as not to disturb the contents of the beaker unduly. 2 c.c.s. of starch solution is also added in the same manner at this stage. Before stirring the acid through the latter, commence to drop the standard iodine solution from a burette. The drops are added in such a way as to distribute them over the top surface of the liquid in the beaker, and simultaneously with the first addition of the iodine solution, the contents of the beakers are cautiously stirred by means of the specially-constructed stirrer shown in the diagram of the apparatus. Too rapid agitation should be avoided

(*Continued on page* 152.)

Notes on Patternshop Management.—III.

By Ben Shaw.

The Position and Layout of the Patternshop.

More attention is given to the relative positions of the various shops of an engineering works to-day than was once the case. It is recognised that correct works-layout and shop-layout have an important bearing on the costs of production. The position of the patternshop in relation to the machine-shop is unimportant, but it is advisable that, where there are foundries, the patternshop should be adjacent to these, not only for convenience in conveying patterns backwards and forwards, but because it is so frequently necessary, especially in dealing with large loam work, for the pattern-maker to be in close attendance on the moulder and at hand for consultation. It is not as important that either patternshop or foundry should be near to the drawing-office, because it is comparatively seldom that draughtsmen visit either of these shops, and in some cases the only communication is through the chief draughtsman or foreman patternmaker.

In a works, like a motor-car works, where the work is small and of a repetition character, the location of the patternshop is not as important as in a shipbuilding yard. It is usual, in the latter kind of establishment, to have the yard shop near the fitting out so that templates and patterns can be taken backwards and forwards without loss of time.

The balcony is quite a common feature of many patternshops. In some works the patternshop is placed on the second floor above the machine shop, with the result that the floor is continually vibrating, and this does not make either for satisfactory bench work or lathe work.

When the patternshop is a two-storied building, or when there is a balcony, careful consideration should be given to the position of the machines. A balcony ought to be at the opposite end of the shop from where the machines are placed. Further, there ought to be machines, such as band and circular saws, on the balcony as well as on the ground floor, to prevent waste of time in running up and downstairs. It is rather surprising that bench planers have not become more popular for patternshop use. A great deal of the patternmakers' time is spent planing narrow timber that could be planed better on a small machine.

Position of Machines in Relation to Benches.

Much depends upon whether the machines are to be driven direct or from a line shaft, and also whether the power-unit is for the patternshop alone. Placing the machines and benches in separate shops has many advantages, but there are some notable disadvantages. The advantages are, broadly, that there is no noise in the patternshop proper and there is no dust. The chief disadvantage is that time is lost in going between bench and machine. The most convenient arrangement is to place the benches on one side of the shop and the machines on the other. This makes for better organisation of the department. As an alternative to this, the machines should be placed at one end of the shop. In addition to bench trimmers there should be several large but portable trimmers about a patternshop, and there ought to be a surface table for common use. It is not reasonable for a foreman to check work on a surface table if the craftsmen have not had the opportunity to test it on a surface table during the process of construction. A surface table is essential in a shop doing small accurate work.

Arrangement of Machine Tools.

Too great attention cannot be paid to good arrangement of the various machines. The patternshop differs from other departments of an engineering works in several important respects. Modern machine shops are designed on the straight-line principle, which means that the raw material enters at one end of the shop, and after consecutive operations, during which it travels from machine to machine in approximately a straight line, emerges as a finished product at the other end of the shop.

In a patternshop, however, there can be no strict subdivision of operations. The man that works at the bench is also, in most cases, a part-time machineman. The work itself does not move in a regular way from one machine to another, but is worked alternatively at the turning lathe, the circular saw or other machine and bench. Thus, other considerations decide upon the location of benches and machines.

In regard to the important question as to whether machines should be close together or a considerable distance apart, this can only be decided after consideration of the size of work that is specialised in by the shop. In a patternshop for small work the machines can be very close together, because no long lengths of timber require to be sawn or planed; but in, say, a marine engineering plant the position is quite different. It is obviously foolish to place a planing machine so close to a band saw that only short timber can be planed and sawn in a shop doing large work; and yet this is often done.

Some consideration should also be given to the sequence of operations when breaking out timber preliminary to commencing the construction of a large pattern. The timber is usually taken to the circular saw or cross-cut saw first, then to the surface-planing machine. The thicknessing machine is next in order, after which the band saw work is done. It is an advantage, therefore, if the machines are so located that the timber does not require to be carried past the machine and brought back to it subsequently.

Line Shaft or Direct Driving.

The electric drive is becoming very common. Its merits and demerits have been much canvassed, but it has many special advantages in a shop like the patternshop, where the machines are used intermittently. There are times, even in comparatively large shops, when no machines are in use, and it is seldom that all are going at the same time, yet there must be sufficient power to drive them all at one time. It is obvious, this being the case, that great economy is possible when each machine is independent. It is sometimes asserted that the action of the belt from the line shaft is "kinder" and takes up unequal strains—to use a wrong but fitting word—caused by knots and hard patches in the timber, or, in the case of planing machines, boards of unequal thickness. Such objection to the direct drive is greatly the result of prejudice, and there are few who, after experience, do not prefer it to the line shaft.

Dust Removal.

In the patternshop there is a great quantity of dust, sawdust, and shavings, and both for health and productive reasons these should be minimised. Not many patternshops have got beyond the man with the brush, but the installation of a suction system that takes the waste away from the several machines is certainly an expenditure that is worth while. In some large patternshops not only suction pipe but line shafts are under the floor, the result of this being that the shops are remarkably tidy.

In some patternshops the face lathe is of greater importance than the centre lathe. With regard to the location of the lathes, it is advisable that they should be kept quite clear of the other machines, and as far from the benches as possible, to guard against accidents. The most satisfactory position is alongside the wall, and just a sufficient distance from it to allow the work to swing clear.

In equipping new patternshops an expenditure on new benches, fitted with tool racks and drawers and with good vices is well worth while. Wooden vices are not often seen nowadays, and the screw-lug is also becoming obsolete. The most satisfactory type of vice is one with quick action, and preferably one that can be tilted to any angle. Some patternshops have now small trimmers fixed to every bench, and as trimming machines that are used in common are often in a deplorable condition it makes each craftsman responsible for his own machine. It is reasonable to suppose that small power-planing machines will, in the not distant future, be part of the patternmaker's bench equipment. Several types of such machines are now on the market, and although they have not yet become popular in this country, their use is growing in America, and they certainly save much planing.

Patternshop Machinemen.

In discussing patternshop labour in a previous article nothing was said about a very important person — the machine man. Woodworking machinery is only valuable if it displaces hand labour, therefore if an operation has to be performed—a finishing process—that has previously been done on a planing or other machine, instead of being an economy the machine is an additional burden on establishment charges. It should not be just anybody's business to keep the machines in order, but a highly-skilled machinist, patternmaker or not, should have full charge. It should also be this man's business to see that wasteful cutting is not practised. It is no unusual thing for timber to be reduced considerably in thickness at a planing machine when the circular saw ought to have been used first, and a thin board instead of shavings obtained. At band and circular saws also there is frequently avoidable waste which it is not always possible for a foreman to see. A great deal of pattern construction must always be done by hand, and machinery will never be more than a good auxiliary, but in many classes of work costs can be reduced 30 to 40 per cent. by the elimination of hand labour wherever possible. Unlike the metal-machine shop the types of machines suitable do not depend on the class of work to be done.

It is a very small shop, indeed, where a qualified machinist would not be profitable, and in a larger shop, where the man's time would be fully occupied sharpening tools and repairing belts, there ought to be a handyman whose duties would be chiefly to attend to oiling and cleaning. Very often a man is expected to sharpen the saws and planing-machine knives, without allowing such work to interfere with his ordinary work, but in all but the smallest shops it is profitable to employ a whole-time machinist. Unless woodworking machines are in excellent condition they are inaccurate and leave so rough a surface on the timber that a great deal of hand finishing is necessary. It should never be necessary for the patternmaker to plane wood that has been over a planing machine, nor to touch half-laps that have been cut at the circular saw. There is no reason why timber worked at a machine should not be as well finished as lumber worked at the bench.

The machining in some shops is done by special men who may be skilled patternmakers or simply machinists. It is doubtful if it is advantageous to make a distinction between bench work and machine work. It may be, indeed, generally is, profitable to employ a man whose sole duty is the care of the machines; it is inadvisable to have the machining done by this man. The patternmaker finds it impossible to explain in detail what he wants the machine to do, and if another does the machining there will be more hard work necessary in finishing than there ought to be. On the other hand, it is probably true that the machinist will be more careful in using the correct machine for each job. He will not use a band saw for ripping thick timber, or the circular saw for cutting curved pieces of timber, such as segments.

Shop Lighting.

There is no shop in which lighting is more important. There should be a sufficiency of windows and top lighting is best. In shops where the work is small and must be accurate portable lights at each bench are practically essential. It is, perhaps, more important to have the machine well flooded with light than the benches.

In laying out a patternshop for small work the question of mechanical handling of patterns and coreboxes is of no concern, but in machine-tool and marine shops there must be an overhead runaway. We have heard it urged that electric runaways in patternshops are labour saving, but this is very doubtful as it is very seldom there is any heavy lifting.

THE FOUNDRY INDUSTRY of CZECHO SLOVAKIA

by PROF. DR. MONT. FR. PISHEK.

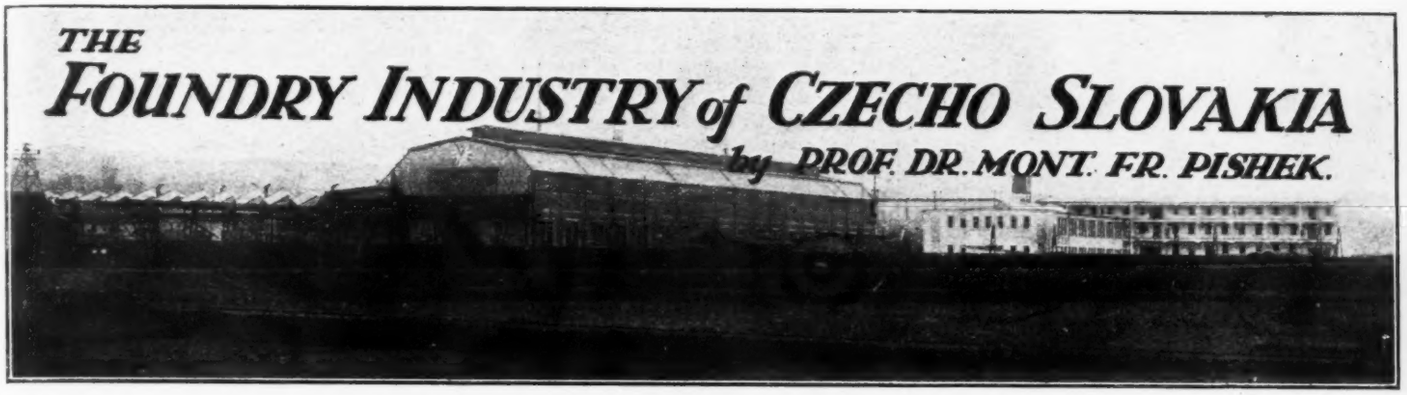


Fig. 5.—The Engine and Wagon Works Company's Foundry at Brno (Brunn).

Early Beginnings.

Beyond the district of Moravská Ostrava, mentioned in the author's previous article,* there are the districts of Brno (Brunn) with its great engineering industry and important sand deposits of high quality; of Prague in northern Bohemia and the district south-west of Prague on the river-basin of Berounka. All these districts are shown in Fig. 1, from which it will be noticed that some of these districts are situated a long distance from the coke-making region centred in the river basin of the Berounka.

Most of the foundries grew up in the Brno district because a hundred years ago, before the days of steam, this forest region provided water power and contained small ore deposits, which gave birth to numerous charcoal blast furnaces. Later, many of these small iron works were converted into iron foundries. Another very important reason for their existence is the central position of this district, lying as it does between Prague and Vienna—the largest industrial towns of the old Monarchy.

After the creation of Czechoslovakia, the location of the foundries in this district, which formerly was very favourably placed, became disadvantageous. They are now forced to transport the raw materials, coke, and much of pig-iron from Vítkovice—a distance of about 250 miles. Moreover, they are situated on the frontier. The pig-iron from the iron works of Králuv Dvur, which is situated in this region, cannot be used for engineers' castings on account of its high phosphorus content.

Again, the district of Brno, which formerly was directly connected with Vienna, is to-day more unfavourably situated than the district of Berounka, although it is actually much nearer.

Still worse is the location of some of the erstwhile prosperous iron foundries in Slovakia and Subcarpathian-Russia. Thus it is evident that the unfavourable location of some foundries forms a hindrance to their prosperity; but by standardisation and the rationalisation of the industry through bringing the technical equipment up to date has reduced the cost of production so greatly that it has enabled them to compete both at home and abroad.

Pig-Iron Available.

The Czechoslovakian iron works produce coal-smelted foundry pig-iron of medium and of high phosphorus content, and hematites containing between 0.15 and 0.2 per cent. of phosphorus. The principal Czech foundry pig-iron brands are:—Vítkovice, Trinec and Králuv Dvur. The first two brands are classed by the silicon content and numbered I and III. Their chemical composition is as follows:—

No. I.—TC, 3.3 to 4.0; Si, 2.0 to 3.0; Mn, 0.4 to 1.2; P, 0.5 to 1.1; and S, 0.01 to 0.03 per cent.

No. III.—TC, 3.0 to 3.8; Si, 1.2 to 2.0; Mn, 0.4 to 1.1; P, 0.5 to 1.1; and S, 0.03 to 0.06 per cent.

Most of the foundry pig-iron is sand cast, but the Trinec concern also casts a small part of its production into chills; but it is the custom of most of the foremen to evaluate the pig-iron from the appearance presented by the freshly-fractured surface, and this has prevented the expansion of pigs cast into cast-iron moulds—a method really advantageous to the foundryman.

No. 1 foundry pig-iron, containing a higher percentage of silicon, is coarse-grained; its normal manganese content amounts to 0.6 to 0.7 per cent. The phosphorus is usually about 0.8 per cent. Only one brand, "Králuv Dvur," has a higher phosphorus content of about 1.3 per cent.

Hematites are manufactured at Vítkovice and Trinec, and classed similarly to foundry irons as No. I and No. III. Their average composition is:—*No. I.*—TC, 3.4 to 4.2; Si, 2.0 to 3.2; Mn, 0.4 to 1.2; P, 0.13 to 0.2; and S, 0.01 to 0.03 per cent. *No. III.*—TC, 3.2 to 3.9; Si, 1.3 to 2.0; Mn, 0.4 to 1.0; P, 0.13 to 0.2; and S, 0.03 to 0.06 per cent.

No. I has a coarse fracture and No. III fine.

* See our last issue, page 129, *et seq.*

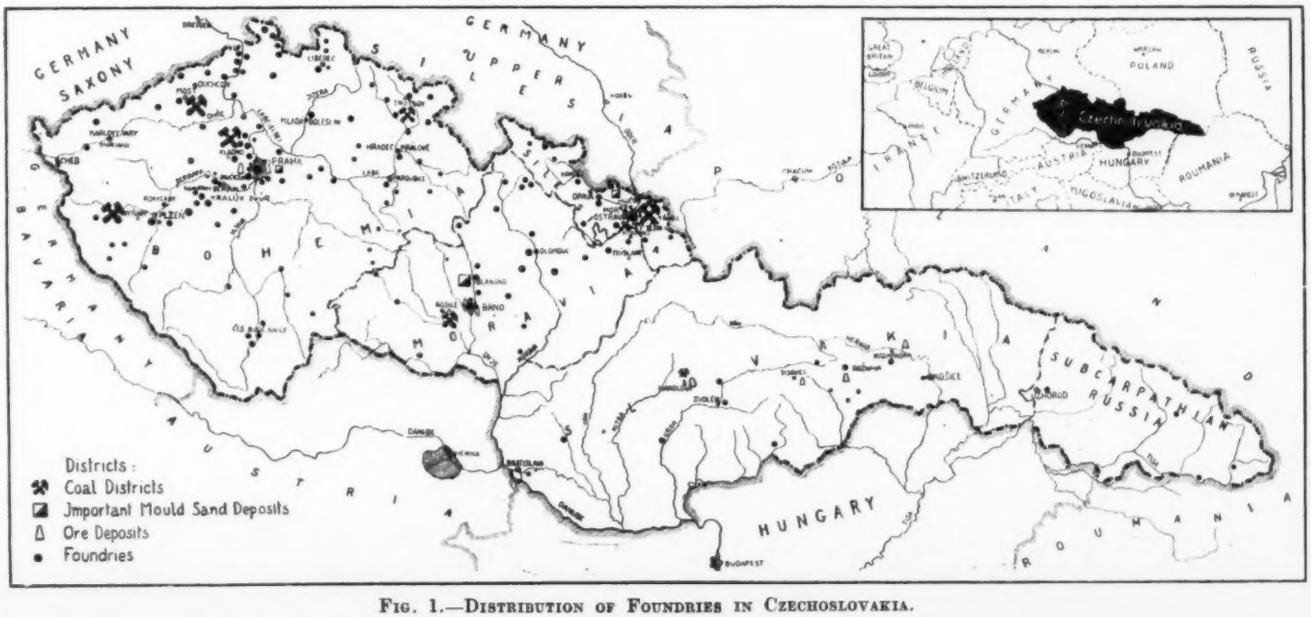


Fig. 1.—Distribution of Foundries in Czechoslovakia.

The phosphorus content of Czech hematite is higher than those of English hematite, and consequently, the local foundries import the latter in large quantities. For special kinds of cast iron Swedish charcoal iron is imported.

The principal Czech iron works, "Vítkovice," "Bánská horní a hutní," and Prazská železárská," have established a consortium for the sale of pig-iron called the "Prodejna sdruzenych ceskoslovenskych železáren" (Sales Bureau for the Federation of Czech Iron Works). They sell the

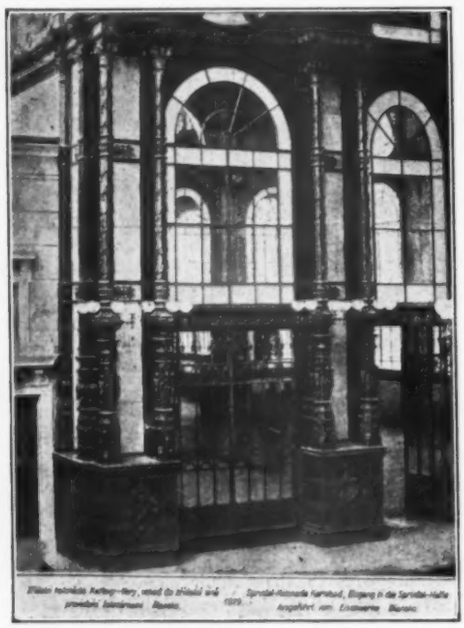


Fig. 2.—Cast-Iron Entrance Gate to the Famous Colonnade at Karlovy-Vary (Karlsbad), made by the Blansko Company.

pig-iron without any guarantee of its chemical composition. Because the cost of scrap iron is rising from day to day, the larger foundries are substituting part of scrap by a pig-iron known as "Králuv Dvur," possessing a low silicon content.

Foundry Coke.

The best foundry coke for cupola work is manufactured at the plants belonging to the mines "Frantisek" and "Ignaz," in the neighbourhood

Fig. 3.—A Flywheel Casting made in Halves and weighing 50 tons by Skoda.

of Moravská Ostrava. This foundry coke contains from 10 to 12 per cent. ash, about 2 per cent. water, but the sulphur does not exceed 0.8 per cent.

Who's Who in the Czech Foundry Trade.

The Czechoslovakian foundries can be divided into three groups:—

(1) Jobbing foundries, making various castings for general trade purposes.

(2) Foundries created by the engineering works, making castings only for their own use; and

(3) Mixed foundries, making castings not only for general trade, but also for their own requirements.

The layouts and the working conditions are governed by the fact that, except in a few cases, they are not specialised, and cast both small and heavy work. High production is therefore not to be expected.

There are in Czechoslovakia some important foundries manufacturing light machinery castings and various builders' castings, such as stove grates, pots, pans, baths and the like.

The largest foundries of this group making light engineers' castings are Bratri Uxové, at Brno; Zelezárny mesta Rokycan (Rokycany Iron Works, Bohemia); Rosická Bánská spolecnost Zastávká (the Rosice Mining Company, Moravia); Bratri Paríkové (Napajedla, Moravia); Hlubocská a Mariansko údolní akc. spol. pro. prumysl a obchod zelezársky, Marianské údolí (Hlubocek and Marianské údolí, Holloware Company, near Olomouc, Moravia); Moravské ocelárny a zelezárny (Moravian Steel and Iron Works, Olomouc-Repcín); Mariansko-horské zelezárské závody, Marianské Hory (Marianské Hory Iron Works, near Moravská Ostrava), and so on.

Cast-iron hollow-ware is exported in large quantities, three important foundries being mainly responsible for its production. The leading firm is Ferrum, at Frydlant, near Vítkovice, then comes Zelezárny Sedlec (Sedlec Iron Foundries, Bohemia), and, finally, Hoffman Otto, Horovice, Bohemia. Enamelled baths, manufactured by the Akc. Zelezárny v Komárove (Komárov Iron Works, near Horovice, Bohemia), and by the foundries of the Ceskomoravská-Kolben-Danek, at Blansko, form an important Czech export. These baths are world-renowned, the Komárov concern manufacturing more than 2,000 baths annually.

Amongst other important commercial export castings are stoves manufactured in a great many foundries. The leading firms in this branch are Ferrum, at Frydlant (Moravia); Ceskomoravská-Kolben-Danek Blansko, near Brno (Moravia); American Heating, at Kolín, near Prague; J. Stíbr, Prague; etc.

Art Castings.

Artistic castings were formerly the speciality of this country. Cast-iron monuments, statues, and small artistic articles were the pride of all the older foundries. Now the fashion for this art has passed away, but nevertheless one can find even to-day some very fine artistic castings.

A masterpiece in this speciality is provided by the chief colonnade in Karlsbad, cast in 1879 by the Blansko Ironworks, the whole construction being made of cast iron. A view of the entrance gate is shown in Fig. 2.

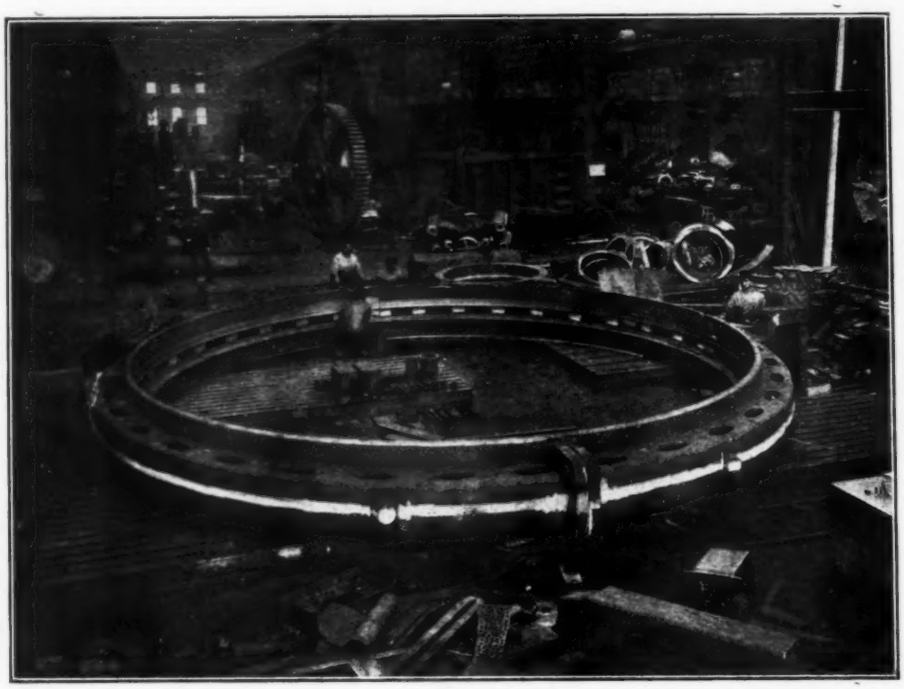


Fig. 4.—Dynamo Frame in Four Sections, weighing 10 tons, made by Skoda.

This colonnade possesses the largest artistic castings ever made by the Blansko Ironworks. The weight of the iron parts of this building, as is well known to visitors to Karlsbad, amounts to 820 tons, and 300 foundrymen were employed six months on work for this building. It is also interesting to note that the memorial statue, the angel, erected in 1873 at Khartoum, on the outskirt of the Camerun Desert, was cast in Czechoslovakia at Blansko.

The second group, *i.e.*, foundries operated by the engineering factories, making castings only for

Fig. 6.—Typical View in a Light Castings Foundry in Czechoslovakia.

their own use, is not extensive; it contains only some special foundries, as, for example, for agricultural machines, etc.

The third group, mixed foundries, making castings not only for their own requirements but also for general trade, is widespread.

To this group belong the foundries of the largest Czech engineering works, such as Skoda; Vítkovice; Ceskomoravská-Kolben-Danek; První Brnenská strojírenská spolecnost (First Engine-Works

Fig. 8.—View taken in the Heavy Castings Foundry of the Vitkovice (Witkowitz) Concern.

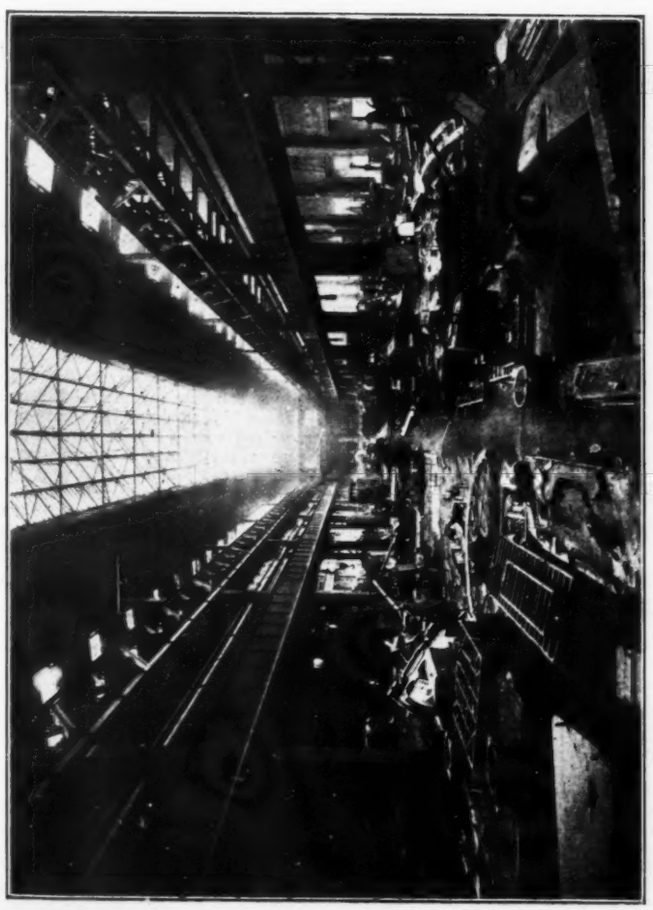


Fig. 7.—View in the Main Bay of the Skoda Foundry at Pleen (Pilsen).

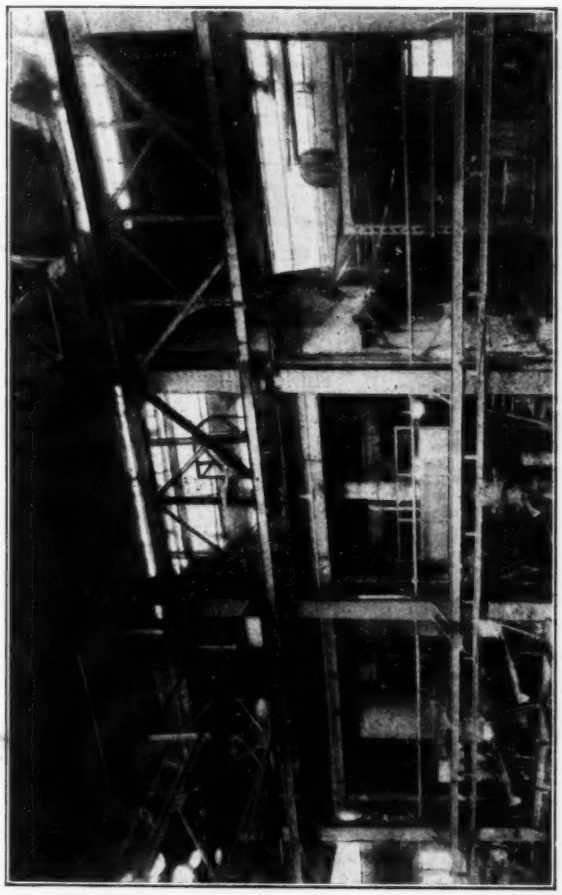


Fig. 10.—Cupola Plant Installed in the Foundry of the Engine & Wagon Works Company of Brno (Brunn).

Fig. 9.—View in a Bay of the Foundry of the Engine & Wagon Works Company at Brno (Brunn).

Company); Brno-Královopolská strojírna (Engine- and Wagon-Works Company); etc.

Typical Castings and the Leading Foundries.

The foundries of these factories are established for making the largest casting to be found in the engineering trades. Figs. 3 and 4 show some heavy iron castings made in the Skoda foundries in Plzen (Pilsen). Fig. 3 shows a flywheel in two parts; the diameter is 7,500 mm., and total weight 50.000 kg. (50 tons). Fig. 4 shows a dynamo in four sections; the diameter is 8,000 mm., and the total weight 10,000 kg. (10 tons). The foundry buildings at Vítkovice cover an area of about 40.000 m², ; whilst those at Skoda 30.000 m². Only a few of the old foundries are made of wood; the new buildings are of steel or of ferro-concrete, as shown in Fig. 5, showing the foundry building of the Engine and Wagon Works Company at Brno.

The equipment of the cast-iron foundries depends on the type of castings manufactured. A typical view in a foundry for light castings is shown in Fig. 6, detailing a bay of the foundry Bratri Uxové (Uxa Brothers), at Brno.

A view of the main bay of the Skoda grey-iron foundry for heavy castings is shown in Fig. 7. Other examples of the interiors of iron foundries for heavy castings are given by Fig. 8, showing a view in one of the foundries of Vitkovice, and Fig. 9, showing a view in a bay of the foundry of Engine and Wagons Works Company at Brno.

Fig. 11.—Cupola Furnaces at the Foundry of the Ceskomoravska-Kolben-Danek Foundry at Praha (Prague).

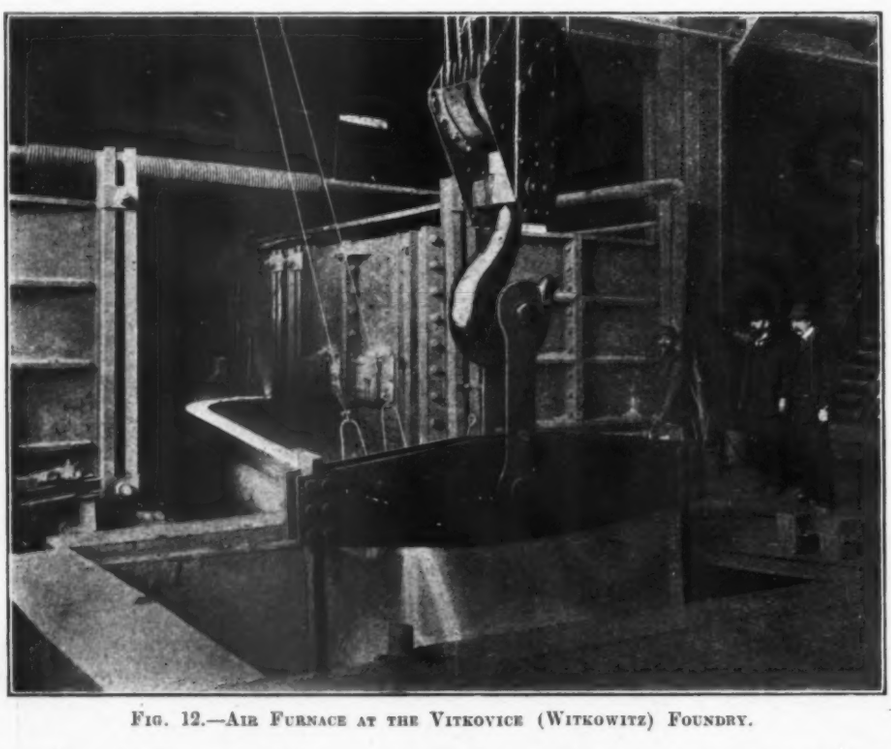


Fig. 12.—Air Furnace at the Vitkovice (Witkowitz) Foundry.

Handling Equipment.

For handling the work, overhead electric travelling cranes are usually installed. In the main bay of the foundries the cranes have generally two hoisting drums on the crab, one for light work, the other for heavy work, or often the local foundries use two travelling cranes, one above the other; the higher generally being for heavy work.

In newer installations, small jib cranes are erected at the side of the main bay. These are either hand operated or provided with a two- or four-ton electric hoisting motor. They prevent loss of time in waiting for the overhead crane.

For light castings the distribution of the melted iron is performed by hand, whilst for heavy castings by overhead cranes. Overhead runways are very seldom used in Czechoslovak foundries.

In the large foundries the composition of the iron is controlled by chemical analyses, and even in the smaller foundries there is unmistakable evidence of a general movement to mix by analysis.

Metal is melted, with few exceptions, exclusively in the cupola. The cupola furnaces usually installed are of medium melting capacity, generally between 4 and 6 tons per hour. Two kinds of the cupola furnaces are to be found; cupolas without a receiver or with a receiver. The foundries making large castings prefer the latter for collecting the molten metals. Generally one can say that in this country the cupola furnaces with a receiver are in great favour.

Fig. 13.—A Group of Melting Furnaces in the Non-Ferrous Foundry of Skoda of Plzen (Pilsen).

Melting Plants.

Fig. 10 shows the cupola plant at the Brno-Královopolská, and Fig. 11 that at the foundry of Ceskomoravská-Kolben-Danek, Prague-Vysocany. The modern foundries have automatic charging apparatus for the cupolas. Most cupolas are provided with one row of tuyeres of varying construction; they are generally of a circular section, or take the form of white tuyeres. The majority of the tuyeres point straight into the cupola, but in the more modern cupolas the placing of these tuyeres at an angle is in favour in order to give special motion to the blast. A second row of tuyeres arranged above the other has not proved satisfactory, and is only rarely employed. The cupolas in the older concerns are furnished with a fan blower, but in the modern foundries with pressure blowers (Roots) or with Rateau blowers. The blast pressure varies from 200 mm. water-gauge up to—800 mm. (8 to 32 ins.).

The lining of the cupolas is generally made of refractory firebricks (acid or neutral) set in fireclay; the ramming of the lining with ganister or other refractories around a wooden template has not been generally successful.

Of advantage for melting in the cupolas, is the fact that the coke has a low sulphur content; thus the castings contain a small amount of sulphur (max. 0.1 per cent.) in heavy castings, that is without any desulphurisation process being installed.

The use of the air furnace for iron melting is limited; they are only installed by the foundries making chill rolls and ingot moulds. Fig. 12 shows the air furnace at Vítkovice employed for making chilled rolls and ingot moulds. The metal flowing either from the spout of the cupola or of the air furnace is caught in ladles and invariably transported to moulds. Pouring at a central station is never employed in this country.

Moulding Sand Preparation.

Moulding sands are never of such a quality that its preparation can be neglected. The commonly used sand-preparing machines comprise the usual mills, rotary sand sifters, automatic riddles, and centrifugal mixers of different types. Very often in Czech foundries the various sand-preparing machines are connected by automatic sand conveyors.

The large foundries prefer the smaller type machines for the mechanical preparation of sand to a large central installation, and recently portable sand-preparing machines, such as the Royer, etc., have come much in favour. Sand cutters so far have not been used. Green sand, dry sand and loam moulds are all used in the local industry. The flasks are generally made of cast iron in the individual shops. For ramming, hand or pneumatic rammers are employed, the latter being now very extensively used.

Mould Drying.

In the Czechoslovak foundries they prefer to make heavy castings, partly into the floor, partly into the flask. Bedded-in moulds have to be dried in the floor by hot air, which is forced through the closed mould. The air is heated in portable coke-fired, mould-drying stoves, into which the cold air is blown by a stationary fan feeding pipes laid across the foundry, which are connected with the dryer or with a small, direct-coupled electric motor and fan. The uneconomical open-firing for drying moulds in the floor is to-day used only in a few badly-managed small foundries.

The fixed drying stoves are fired with solid fuel, the fire-boxes, one, two or three, are placed at the back of the oven. Oil fuel is never used owing to its high price. The more modern plants to-day use stationary drying stoves fired by a small gas producer, built into them, working on the principle of incomplete combustion.

Stoves heated by producer gas generated in large external units are rarely used except where the foundry works day and night or where producer gas is employed throughout the works.

Moulding Machine Equipment.

So far as the moulding machines are concerned, they are used in each foundry in numbers and types according to the production. Thus one finds hand-moulding machines, squeezers and jolt-ramming machines spread throughout the country. The most popular machines are roll-over hand-moulding machines using plaster patterns. Next in favour come hand-moulding machines with pins and stripping plate machines. The squeezers used are either of the hand-press variety or are actuated by means of hydraulic power or compressed air. Jolt-ramming machines are used only when actuated with compressed air. This year both the Komárov Iron Works and Skoda have ordered sand slingers for their foundries.

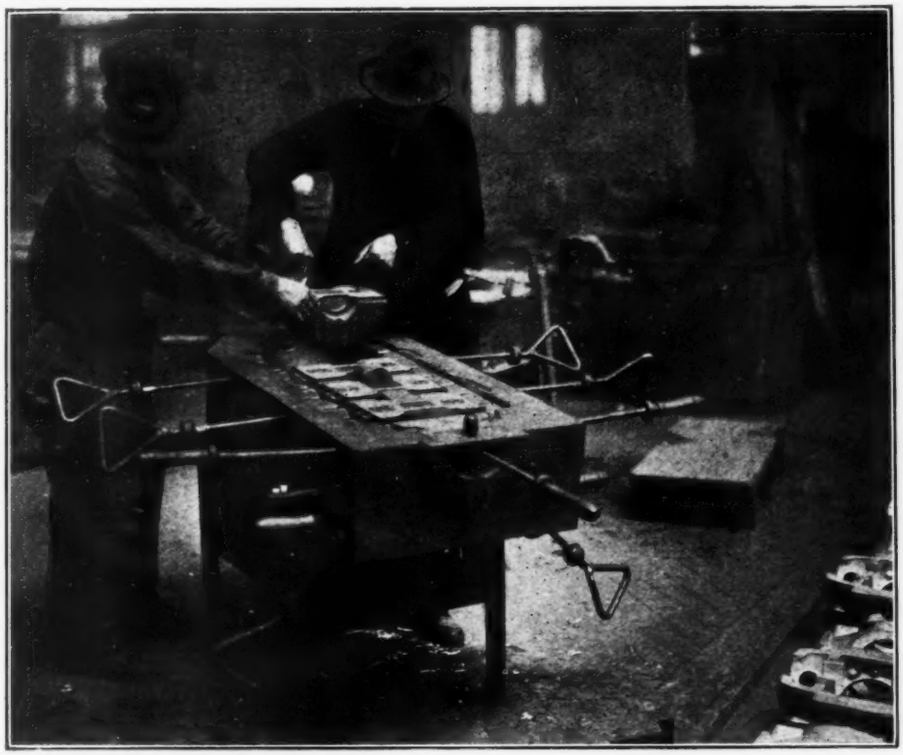


Fig. 14.—Assembling a Composite Aero Engine Cover Casting. The Drag is made of Chills and the Cope of Sand.

Core Making.

Cores are generally made partly in the foundry by the moulder, and partly in separate core-shops, generally situated in a side bay. Large cores are made in dry sand or loam, whilst small ones are made in green sand or clay-free silver sand. Silver sand of good quality is quarried locally, and is also obtained as a by-product from the kaolin factories. As core-binders various oil mixtures, especially linseed oil, are used. Other materials used comprise molasses, which is cheap in Czechoslovakia; glutrin; flour, etc. Generally each foundry has its own binder of a quality found by experience to blend with the local sand. For making small round cores, "sausage" machines are extremely common. Larger cores, if of simple form, are made in some foundries on the jolt-ramming machines.

Because of the nature of the castings made in Czech foundries, the layouts are not modern, viewed from the angle of producing large quantities of components. They possess neither conveyors nor circular tracks; yet increasing business in the automobile industry is causing some of them, as, for example, Ceskomoravská-Kolben-Danek, to establish continuous working in their foundries at least for some types of castings.

Malleable Iron Foundries.

Malleable iron making is an old industry in Czechoslovakia; there is a large business in manufacturing agricultural machines in Czechoslovakia, and this developed the malleable castings trade. Generally speaking, the white heart type of malleable is manufactured, but experiments are now being carried out for the production of the black heart variety.

Amongst the largest malleable foundries are the (1) Ceskomoravská-Kolben-Danek, at Prague; (2) Komárov Ironworks; (3) Ignaz Storek, at

Fig. 15.—Pouring the Mould shown in Fig. 14.

Brno; (4) Uxa Brothers, at Brno, and (5) Olomouc Steel and Ironworks. There is a modern malleable foundry at Jicín (Messrs. Knotek & Company), but it works only as a department of their agricultural machinery business.

For melting malleable iron cupolas are generally used, because the production is not high enough to warrant the continuous working of air furnaces. However, two establishments do use small open-hearth furnaces for the production of malleable iron. These are the Ceskomoravská-Kolben-Danek at their Prague-Vysocany foundry, and Steel and Ironworks at Olomouc; the latter concern makes both malleable iron and steel castings from the same open-hearth furnace.

The annealing of the castings is carried out in ovens where the castings are packed directly into the actual oven, or where they are packed into the pots, which are transferred to the stove. The annealing ovens are either built on or beneath the floor.

Non-Ferrous Foundries.

Copper alloys are generally melted in crucibles in natural-draft or in fan-blown furnaces. Some of the crucibles used are made locally, but many are imported from Germany and England. Generally the non-ferrous foundries are connected with grey-iron foundries, and only a very few independent concerns exist.

The largest non-ferrous foundry is attached to Skoda at Plzen, where the alloys are melted partly in induced-draft crucible furnaces and partly in tilting furnaces, a group of which is shown in Fig. 13. Besides these, there is also a Detroit electric furnace.

Oil furnaces are now rarely used in consequence of the high price of oil, though the Engine and Wagon Works, at Brno, still maintains a battery. Air furnaces are rarely employed, except in the bell foundries.

Aluminium alloys are produced in all the usual compositions, but the American alloys containing copper are much favoured.

For melting aluminium alloys cast-iron crucibles are generally used. Morgan furnaces have been chosen for this purpose by the Ceskomoravská-Kolben-Danek, of Prague-Liben.

For the aluminium alloys chill moulds are often used. Fig. 14 shows a partly-assembled mould for an aero-engine casting; Fig. 15 shows the casting operation for this mould. The ever-increasing demand for non-ferrous castings, especially light alloys, has forced the principal concerns, Skoda and Ceskomoravská, to build modern special-alloy foundries. Skoda constructed theirs at Plzen, and Ceskomoravská at Prague. Another important non-ferrous foundry is the Linzer concern at Liberec. Both Skoda and Linzer produce "electron" metal.

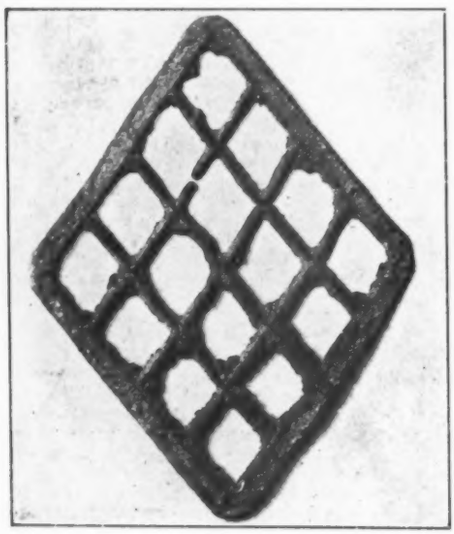
Cast Lead Quarries.

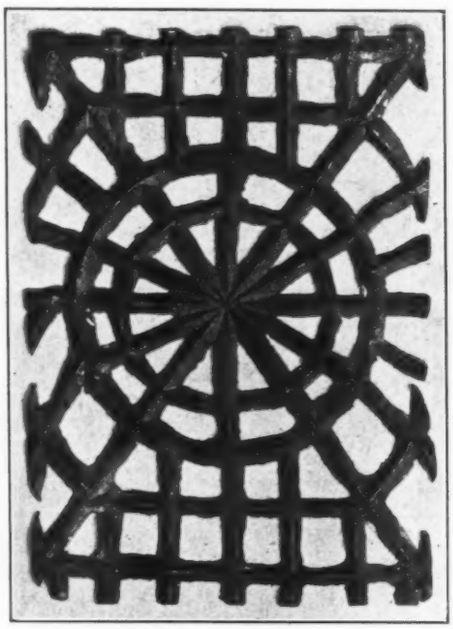
By H. Littlehales.

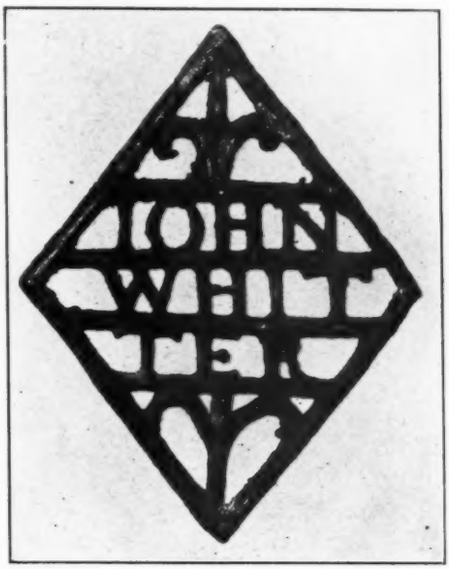
It is probable that not one foundryman in a hundred has at any time seen such castings as are illustrated below.

As a form of ventilation lead quarries were in use for some considerable period; the examples portayed gives a very clear idea that they are by no means a modern conception.

The quarries shown are all of some artistic merit as regards their design and the execution of the casting. They still, after probably some considerable time and use, reflect no little credit upon the foundryman by whom they were cast.







Figs. 1 to 3 show Three Specimens of Lead Quarries.

To-day, if we go into any ancient church we shall not see one of these quarries, and, writing with some degree of hesitation, probably we shall not find them referred to in works on glass, metal, or building. The quarries shown in the picture are in the metal-work department of the Victoria and Albert Museum. We may believe them to have been probably part of the top row of the quarries of a glazed lattice window; they are of clearly later date than the medieval period. The authorities of the Museum consider them to be work of the 16th and 17th centuries. Such castings are extremely rare. We are not able to say whether the name, Iohn Whitter, is that of the designer, founder, or owner of the quarry. The illustration is supplied by the courtesy of the Director of the Museum.

Magnetisation of Single Crystals of Iron at High Temperatures.—Messrs. Kôtarô Honda, Hakar Masumoto and Seiji Kaya, in a recent issue of the "Science Reports" of the Tohoku University, state that they measured the magnetisation of single crystals of iron at different high temperatures by the ballistic method. As is already known, the magnetisation curve at ordinary temperature of an iron rod of a single crystal shows a peculiar course; that is, the curve is almost straight, up to a magnetisation of 1,000 C.G.S. units, then twice shows sharp breaks, till it reaches its saturation value, 1,707. As the temperature is raised, the breaks are gradually displaced towards lower fields, and the saturation value decreases, till it vanishes at the critical point, 790 deg. C. From the saturation of the magnetisation-temperature curve the saturation value at absolute zero is estimated to be 1,752. The relations between the magnetisation and the temperature for the directions of the principal axes are all similar to each other, and also to those for the iron rod.

Notes on the Routine Analysis of Cast Irons and Iron Foundry Raw Materials.

(*Continued from page* 145.)

so as to prevent any chance of loss of H_2S. The titration is continued with constant gentle stirring until a permanent purplish-blue end point is obtained. It is necessary to carry out a blank test, and the number of c.c.s. of iodine added to give the required end point, less the number of c.c.s. used to produce the same end point in the blank, multiplied by the sulphur value of the standard iodine solution, gives the amount of sulphur present.

When possible a standard cast-iron sample should be run with each batch of samples so that the sulphur value of the standard iodine may be obtained under conditions exactly similar to the actual estimations.

For cast irons containing much free cementite the results are usually low, but for ferritic and pearlitic cast irons, provided the limitations of the method are realised, it will give valuable comparative results, and the time taken to carry out the estimation is very much less than that occupied by the gravimetric method.

Estimation of Sulphur in Ferro-Alloys.

This calls for little comment, as in most cases, when using ferro alloys for the manufacture of cast iron, the additions are so small that the percentage of sulphur present in the alloys matters little, and therefore is not estimated. Where necessary, the total oxidation gravimetric method is available. In some cases, of course, it will be necessary to resort to fusion with sodium peroxide to decompose the alloys, and when this is necessary one must take every precaution to ensure, first, the purity of the reagents used in the fusion, and, second, the accuracy of the blank estimation.

Calorimeter for Determination of Heats of Combustion.—Messrs. A. Eucken and L. Meyer describe this apparatus in a German chemical industry paper. It comprises a heavy hollow copper cylinder (250 cub. cm.) with copper lid, carrying the usual ignition apparatus terminating in a thin nickel wire. The material to be burnt (30-40 mg.) is mixed with 6-8 mg. of kieselguhr and pressed into a small briquette which is placed in a conical silver-wire cage in the calorimeter and burnt in oxygen under atmospheric pressure. The temperature is recorded to the nearest one-thousandth of a degree every half minute until constant.

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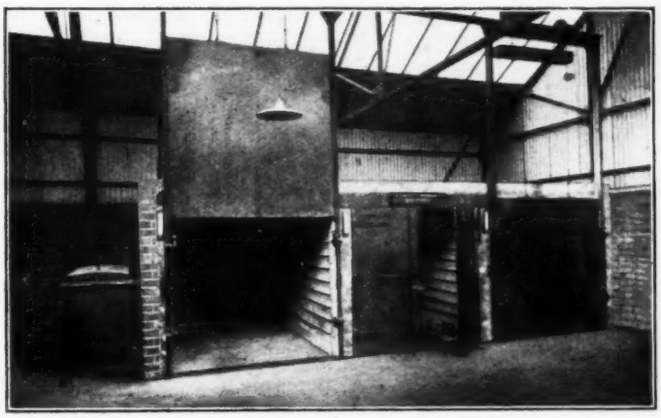

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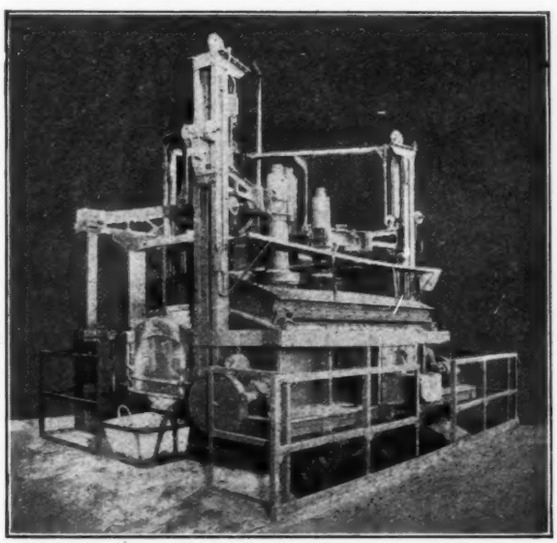

NON-FERROUS METAL MELTING ELECTRIC FURNACES

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Trade Talk.

A company is to be formed by Dutch, Belgian and French promoters to erect a plant at Rozendaal, in Holland, to produce steel in electric furnaces.

The Union-Castle Line have ordered from Messrs. Harland & Wolff, Limited, Belfast, a twin-screw passenger motorship of about 10,000 tons gross.

Allotment letters in connection with the recent issue of 600,000 ordinary shares of 10s. each in the Mond Nickel Company, Limited, have been posted.

The address of the Bristol office of the British Reinforced Concrete Engineering Company, Limited, is now Refuge Assurance Buildings, Baldwin Street, Bristol.

Messrs. Harland & Wolff, Limited, have launched from their Greenock shipyard the only vessel which they have on hand for construction at that establishment, and the yard will now be closed for an indefinite period.

Messrs. Workman, Clark (1928), Limited, Belfast, have received an order from Sir John Ellerman for a vessel of about 7,000 tons. The engines are to be of the four-cylinder triple-expansion type, combined with an exhaust-steam turbine.

The employers' time-limit for the strikers at Tata's works, Jamshedpur, expired on August 20, but very few returned to work. Mr. Subhas Bose, the President of the Labour Union, addressed a mass meeting, where it was resolved to go on with the strike.

Messrs. Thomas Perry & Son, Limited, Highfield Works, Bilston, inform us that their tender for two heavy shearing machines, arranged for direct-motor drive, for shearing non-ferrous metals, has been accepted by the Australian Commonwealth Government.

Recent contracts secured by Messrs. William Beardmore & Company, Limited, Dalmuir, include a steam tug, with engines of 800 i.h.p., for the Falmouth Dock and Engineering Company, Limited, and a Bauer-Wach exhaust-steam turbine installation for the New Zealand Shipping Company's steamer "Tasmania."

Up to the beginning of August the Ruhr Works have shipped from Rotterdam altogether about 70,000 tons of pipe line for the oilfields in Russia under a recent contract. Small lots have been shipped from Hamburg, and it is estimated that with the small balance yet to go the total quantity shipped under that contract will come to about 75,000 tons.

Messrs. Sir W. G. Armstrong, Whitworth & Company, Limited, launched for the United British Steamship Company, Limited, from their Walker shipyard recently the single-screw cargo steamer "Sinnington Court," of 9,600 tons deadweight. The propelling machinery is being manufactured and installed by Messrs. J. G. Kincaid & Company, Limited, Greenock.

Petitions for the confirmation of the reduction of the capital of the Pearson and Knowles Coal and Iron Company, Limited, from £2,500,000 to £1,155,258 6s. 8d., and of the Partington Steel and Iron Company, Limited, from £1,600,000 to £116,666 13s. 4d., were heard before Mr. Justice Charles, at the Royal Courts of Justice, London, on Wednesday, August 29.

The new works for the construction of Ford cars, which are to be erected at Dagenham, Essex, will include, it is stated, steel furnaces, rolling mills, and a large power station. The factory will cover 30 acres of a 300-acre site at Dagenham. A wharf will be built out into the river, and railway sidings and roads laid out. Preparations for the commencement of the work of construction are in hand. Some of the work now being carried out at Cork is being transferred to Trafford Park, Manchester, on account of the import tariff.

About a year ago Leicester Corporation ordered two Howden-Ljüngstrom air preheaters to operate in conjunction with two existing boilers at Freemans Meadow Power Station. The Corporation have now placed a repeat order with Howden-Ljüngstrom Preheaters (Land), Limited, for preheaters for four further boilers, and have also ordered the same make of preheater for pulverised-fuel-fired boilers now under construction for the new extension to the power station.

Messrs. Richardsons, Westgarth & Company, Limited, of Hartlepool, have received an order from the Corporation of Douglas, Isle of Man, for the main equipment of the new power station to be erected at Pulrose. The plant comprises a battery of the company's patent vertical-tube Nesdrum water-tube boilers, coal and ash-handling plant, and all boiler-house accessories, a Richardsons Westgarth-Brown Boveri steam turbine, with gear-driven alternator, surface condensing plant, feed-heating system, cooling tower, etc. The reported contract value is over £28,000.

Agricultural & General Engineers, Limited, of Aldwych House, Aldwych, London, W.C.2, have decided to co-ordinate the Australian interests of their 14 associated companies by appointing Mr. A. Simpson, formerly H.M. Trade Commissioner in Sydney, to act as their resident chief representative in Australia. Mr. Simpson's appointment will in no way interfere with any existing agency arrangement.

The Butterley Company, Limited, Derby, have just completed the construction of a large bridge which is being erected at Appleford Viaduct to carry the Great Western Railway line between Didcot and Culham, on the London and Oxford section. The bridge consists of three bow-string lattice girders, and 500 tons of iron and steel have been used in its construction. To ensure the members fitting accurately together at the site, the steel work was first assembled at the Butterley Works.

Buell Combustion (Foreign), Limited, have informed their shareholders of the formation of a company to operate the Buell patents in France, Belgium and their Colonies. The Compagnie Française Buell Combustion Soc. Anon is to be incorporated under the laws of France with a capital of 12,000,000 francs. The new company have acquired the patents and goodwill from the Anciens Etablissements Loy and Aube, of Paris, in connection with pulverised coal, and will complete the existing contracts of this company. They have also acquired from the Buell Combustion (Foreign), Ltd., the whole of the Buell patents for France and Belgium.

An extension of the present export prohibition on Swedish scrap iron, which is to remain in force until the end of August, has been urged by all Swedish iron and steel works who consume scrap iron. The Jernkontoret (Iron Masters' Association) has written to the Swedish Board of Trade (Kommerskollegium) pointing out the absolute necessity of prolonging the embargo, as the present total stock of scrap for the ironworks amounts to only 23,650 tons instead of the normal quantity of 40,000 tons, while the annual supply needed is estimated at 157,000 tons. Prices of Swedish scrap iron, in spite of stopping exports, have been rising continuously, and are now higher than in neighbouring countries.

The International Combustion Engineering Corporation, of New York, have received one of the largest contracts in the history of the company. The New York Edison Company have placed an order for four complete steam-generating units, each of which is guaranteed to produce 550,000 lbs. of steam per hour on normal load, with an overload capacity of 800,000 lbs. of steam per hour. The boilers will be of the double Ladd type, and will be designed for a maximum pressure of 500 lbs. and an operating pressure of 425 lbs. The furnaces will be equipped with C-E fin tubes, C-E fin tube arch screens, Lopulco water screens, Lopulco (couch-type) burners, and Lopulco, Type R feeders. Eight C-E air preheaters will be installed. The pulverising plant will consist of six Raymond supermills, all of which will be equipped for air drying in the mills themselves, and will have sufficient capacity to meet the requirements of the six existing and the four new boiler units.

Contracts Open.

Buenaventura, Colombia.—30,000 metres of 12-in. piping (plus 5 per cent. as spares), lap-welded steel, Mannesmann type or riveted; 3,000 metres of 8-in. piping; and 500 metres of flexible joint piping; also valves, sleeves, bends, tees, etc., for the Colombian Pacific Railways. The Department of Overseas Trade. (Reference A.X. 6718.)

Cairo, September 29.—Two stone-crushers and one plant for pulverising limestone, for the Public Works Ministry. The Department of Overseas Trade. (Reference A.X. 6666.)

London, S.E., September 4.—2,150 cast-steel or malleable cast-iron axleboxes, and wheel centres for locomotives, for the India Store Department, Belvedere Road, Lambeth, S.E.1. (Fee 5s., non-returnable.)

London, S.W., September 4.—6,273 axleboxes for carriages and wagons (cast steel or malleable cast iron), and 1,050 steel tyres for carriages and wagons, for the Madras and Southern Mahratta Railway Company, Limited, 25, Buckingham Palace Road, Westminster, S.W.1. (Fee £1 1s., non-returnable.)

Warrington, September 1.—3-in. cast-iron water pipes, for the Water Committee. Mr. J. Gray, waterworks engineer, Municipal Offices, Warrington.

Acid-Resisting Refractory Bricks.—The General Refractories Company, Philadelphia, U.S.A., announce that they have developed a new refractory brick which is highly resistant to acid attack. This brick will be marketed under the name of "Acido," and is intended primarily for use in zinc and copper plants, etc.

Personal.

Mr. J. F. Bridge has been appointed secretary of Messrs. John Brown & Company, Limited, of Sheffield and Clydebank, in succession to the late Mr. E. Middleton.

Mr. B. W. Hewitt has resigned his position as manager of the Mining Machinery Department of the Brightside Foundry & Engineering Company, Limited, to take over the management of the Mansfield Engineering Company, Limited, Hucknall, Notts. Mr. Hewitt will take up his new position at the commencement of next month.

Mr. James Lawson, who recently resigned his appointment as managing director of Messrs. E. Cockey & Sons, Limited, gas works plant and constructional engineers, Frome, Somerset, which post he held for the last 13 years, has joined the firm of Messrs. Bamag-Meguin (G.B.), Limited, engineers and contractors, Broadway Buildings, Westminster, S.W.1.

Mr. Thomas G. Sorby, managing director of Messrs. Thomas Sorby & Sons, Limited, iron and steel merchants, of Sheffield, was recently elected Master Cutler of the Cutlers' Company of Hallamshire, an office which has existed since 1624. Mr. Arthur K. Wilson, managing director of Messrs. Spear and Jackson, Limited, steel saw and tool manufacturers, of Sheffield, was elected Senior Warden, and Mr. Peter B. Brown, managing director of Messrs. Hadfields, Limited, of Sheffield, Junior Warden.

Mr. H. J. Young, F.I.C., has taken into partnership Mr. George Shaw, M.Sc. (Durham), and a practice is being conducted under the style of Young & Shaw, analytical and consulting chemists, at 497A, Shields Road, Walker Gate, Newcastle-on-Tyne. Until recently Mr. Shaw was for three years in partnership with Mr. Stock, Public Analyst for Durham County. Moreover, he has experience on coke ovens and in the manufacture of manures, fish oils, etc. The Newcastle laboratories under Mr. Shaw's personal supervision now consist of three departments :—(*a*) Foods; drugs; waters; paints; agricultural materials; and colliery materials; (*b*) metals and alloys; ores; fuels; lubricants; engineering and shipbuilding materials; and (*c*) outside department: Testing of tank steamers for gas freedom; cleaning of condensers; inspection of castings and forgings; engineering and manufacturing problems; foundry mixtures, problems and organisation; and gas testing. Mr. Young is to continue his practice at 3, Central Buildings, London, S.W.1, but will visit Newcastle monthly.

Wills.

Bristow, J., of West Norwood, S.E., director of the United Flexible Metallic Tubing Company, Limited £9,133

Martin, A. A. (76), of Tressillian Road, Brockley, S.E., retired secretary of Messrs. W. H. Wilcox & Company, Southwark Street, Borough, S.E. £10,738

Powell, R., of Packwood, Warwick, brassfounder £21,556

Robinson, F. A. (70), of Sunnybank, Lucknow Drive, Nottingham, managing director of Sanderson & Robinson, Limited, ironfounders, Mansfield £11,128

Twemlow, S. P., of Sandbach, Cheshire, managing director of Foden's, Limited £34,524

Ni and Ni Cr in Cast Iron.

We are indebted to Mr. T. Henry Turner, M.Sc., for pointing out a translation error which appeared in the last paragraph of an article entitled "The Critical Points and Martensitic Quench in Nickel and Nickel-Chromium Cast Iron" (page 112 of our issue of August 16). The final conclusion should indicate that the French workers have found that it is possible to make nickel and nickel-chromium cast irons which

(*a*) can be cast as easily machineable and subsequently hardened by heating to about 800 deg. C. and cooling in still air, or

(*b*) similar cast irons, resembling self-hardening steels, too hard in the "as cast" condition to be machined, but easily machineable after being annealed for a short time at 650 deg. If these are then machined, they can be finally hardened by heating to about 900 deg. C. and cooling in air.

Mr. S. Kane, a director of Messrs. Kane Brothers, Limited, ironfounders, of Ballymena, Co. Antrim, died recently.

The Capponfield Furnaces, belonging to Messrs. T. & I. Bradley, Limited, are being relit to-day.

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ALL YOUR NEEDS
IN
REFRACTORIES
AND MINERALS
CAN BE AMPLY FILLED BY
The General Refractories Co. Ltd.
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Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Owing to holidays and the local race meeting, the current week's business in the Cleveland iron market has been practically without interest to buyers and sellers alike, and in Tees-side opinion very little change for the better may be expected during the next few weeks. Deliveries to works having been temporarily suspended, there has been some accumulation of stocks at the blast furnaces, but output is so limited that the reserves of pig-iron at makers' works are quite small and any reasonable expansion would speedily exhaust them altogether. Already a fair volume of inquiry is developing, chiefly from home consumers, but also to a limited extent from overseas, and the general belief is that a definite improvement will not be much longer delayed. Meanwhile, prices still keep very firm, as follows:—No. 1 Cleveland foundry iron, 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; No. 4 forge, 64s. 6d. per ton.

There is still a good deal of irregularity in regard to prices of East Coast hematite. Some makers hold out for 70s. to 71s. per ton for mixed numbers, whilst on the other hand export sales are reported at 68s. 6d. per ton. But the general tone of the market is firmer, and, as stocks have been reduced, makers are in a better position to maintain prices at a reasonable level. On the North-West Coast prices are well maintained at 68s. per ton for Bessemer mixed numbers, f.o.t. at works.

LANCASHIRE.—The temporary recovery, noted in last week's report, of the local markets for foundry pig-iron has not been sustained, and buying interest has again relapsed to its former apathetic condition. In the meantime prices remain at about previous levels, Derbyshire No. 3 being quoted round 67s. 6d., Staffordshire 67s. to 67s. 6d., and Scottish 87s. 6d. to 90s., all including delivery Manchester or equal distance.

THE MIDLANDS.—Existing conditions in the foundry industry throughout this area sufficiently explain the present position in local iron markets, business being mainly concerned with limited dealings to meet current requirements, very few forward transactions being traceable. Prices are practically stationary. Northamptonshire No. 3 is quoted at 55s., Derbyshire 59s., to 60s., with North Staffordshire No. 3 59s. to 60s. at furnaces.

SCOTLAND.—Business in the Scotch pig-iron market remains exceedingly slow, and buyers are only prepared to purchase their immediate needs. In spite of the slackness, there is no easing in prices, quotations still ruling at 70s. 6d. per ton, f.o.t. furnaces.

Finished Iron.

The manufacturing branches in the Staffordshire area still find very keen competition from Derbyshire and Lancashire works for crown iron, and there is nothing near sufficient business to be had to keep the mills going. The orders which are developing do not represent any bulk tonnage, being of a most miscellaneous nature. The prices of English iron, of whatever quality, are without change. Crown iron is quoted from £9 to £10, and nut and bolt iron from £8 12s. 6d. to £8 17s. 6d., delivered locally. The makers of marked bars are only moderately engaged, but adhere to the figure of £12 at works for this class of iron.

Steel.

The position in the steel industry continues unsatisfactory, both as regards home and foreign products, and at Sheffield the market has been quiet throughout, with only a small demand for billets, both acid and basic. Wire rods are, if anything, a trifle more active, but even so business is very unsatisfactory. Current quotations:—Siemens acid billets, £10; basic billets, soft, £6 5s.; semi-hard, £7; medium, £7 2s. 6d.; hard, £7 12s. 6d.; soft basic wire rods, £7 5s. to £7 10s.; medium hard, £9; hard, £11 10s. to £11 15s.; acid, £13 10s. In the tinplate market there has been a better feeling all round recently, buyers being more disposed to book their requirements. Sales at 18s. were again reported, but current rates for coke quality are ruling at 18s. to 18s. 3d. basis, net cash, f.o.b. Welsh ports.

Scrap.

August, invariably a poor month for business, has, on this occasion, been unusually quiet as regards dealings in scrap metals, and with few exceptions markets have been without features of special interest. In the North-Eastern area, however, some of the foundries are very busy, and have not wholly suspended operations during the holiday period. Thus heavy cast iron is quite steady at 60s. per ton for ordinary quality, and 65s. for machinery quality in handy pieces. In Scotland some merchants now view the position with a little more optimism, and believe that, as scrap in general is not too plentiful and Continental prices are rather high, a slight improvement might be forthcoming soon. The cast-iron scrap market is still easy, with little business moving; consumers seem to be fairly well supplied, and also have stocks in hand, consequently they are not at the moment anxious buyers. The price for first-class machinery metal is still around 65s. to 66s., and heavy ordinary quality 60s. to 62s. 6d. Old cast-iron railway chairs are around 65s. to 67s. 6d., and light cast-iron scrap 57s. 6d. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—Recent movements in the market for warrant copper provide convincing evidence of the continued steadiness of values, on a very moderate turnover of little over a 1,000 tons average per week, and with only a quiet demand on forward account. The strength of the position is confirmed by outside reports making it quite clear that a steadily increasing world output is being more than covered by a corresponding expansion in consumptive demand, and it follows that values, which still stand at an unnaturally low level, must reflect this view of the situation before very long.

Closing quotations are :—

Cash.—Thursday, £62 11s. 3d. to £62 12s. 6d.; Friday, £62 12s. 6d. to £62 13s. 9d.; Monday, £62 12s. 6d. to £62 13s. 9d.; Tuesday, £62 11s. 3d. to £63 12s. 6d.; Wednesday, £62 8s. 9d. to £62 10s.

Three Months.—Thursday, £63 to £63 2s. 6d.; Friday, £63 to £63 2s. 6d.; Monday, £63 to £63 2s. 6d.; Tuesday, £62 18s. 9d. to £63; Wednesday, £62 15s. 3d. to £62 17s. 6d.

Tin.—Values of standard tin during the past week have again expressed the erratic tendency so long experienced in this section of the market, and from present indications there is still no sign of that stability and firmness which the actual balance of world output and consumption would seem to justify. Meanwhile, there are again reports of heavy supplies coming to hand, so that a further drop in values would seem to be an immediate possibility.

Official closing prices :—

Cash.—Thursday, £212 10s. to £212 15s.; Friday, £211 to £211 5s.; Monday, £208 15s. to £209; Tuesday, £210 to £210 5s.; Wednesday, £209 12s. 6d. to £209 15s.

Three Months.—Thursday, £209 5s. to £209 10s.; Friday, £207 to £207 5s.; Monday, £205 10s. to £205 15s.; Tuesday, £206 15s. to £207; Wednesday, £206 15s. to £206 17s. 6d.

Spelter.—Considerably more activity in the market for ordinary spelter has developed of late, although actual buying by consumers is still, perhaps, somewhat disappointing. A considerable volume of inquiry is, however, circulating, and the outlook is generally considered to be much brighter. Last week's values show a slight decline, but the drop would doubtless have been much more severe but for the revival of interest on the market.

Daily quotations are :—

Ordinary.—Thursday, £24 10s.; Friday, £24 8s. 9d.; Monday, £24 10s.; Tuesday, £24 12s. 6d.; Wednesday, £24 15s.

Lead.—The most active section in the non-ferrous metal markets of late has been unquestionably that for soft foreign pig, favoured by the strength of the statistical position. Arrivals of the metal in the first seven months of the year have been curtailed by over 11,000 tons, compared with a year ago, and it is believed that the greater part of the large surplus which accumulated in the earlier months has now been liquidated. Russian demand has also been particularly active of late, and prompt metal has been advanced to a premium of 22s. 6d. a ton, an improvement of over £2 per ton on the lowest price touched this year. For the moment, moreover, there is every indication that the present movement is likely to continue, and that lead has yet to reach its highest level for this quarter.

Closing prices :—

Soft Foreign Prompt.—Thursday, £22; Friday, £22; Monday, £22 1s. 3d.; Tuesday, £22; Wednesday, £22 2s. 6d.

Patent Specifications.

The following list of Patent Specifications accepted has been taken from the "Illustrated Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each. The last numbers given are those under which the Specifications will be printed and abridged, and all subsequent proceedings will be taken.

9,041. Minerals Separation, Limited (Taplin, T. J.). Leaching of ores. 294,921.

13,053. Bolckow, Vaughan & Company, Limited, and McLean, M. A. Bricks for the checker work of blast and other furnace stoves and regenerators. 295,075.

17,823. Watkins, W. E. Feeding of metal strips in suspended form through furnaces or other treating devices. 282,623.

29,751. Gustafsson, E. G. T. Method for producing metals from their sulphides in electric furnaces. 280,540.

30,067. Soc. D'Expansion Technique. Centrifugal casting of metal pipes. 280,557.

32,375. Broken Hill Proprietary Company, Limited. Blast furnaces. 282,042.

33,618. Noble, E. E. Water-tube boilers. 295,171.

(*On sale September* 6, 1928.)

3,824. Rowlands, T. Processes and apparatus for the treatment of metallic ores, etc. 295,338.

9,362. Smith, S. C. Treatment of ores, residues, etc., for extracting metal values. 295,224.

9,511. Wilder, F. L., Morris, E., Schiff, E., and King, E. S. Treatment of metalliferous ores, natural sulphides, arsenides, mattes, hardheads, and other metallurgical products which may have been made into forms with a binder. 295,226.

9,676. Wiggin & Company, Limited, H., and Lobley, A. G. Mounting or suspension of resistance in electric furnaces. 295,299.

10,174. Siemens, Bros., & Company, Limited, and Hubbard, E. R. Manufacture of lead-sheathed cable and apparatus therefor. 295,416.

11,737. Haglund, T. R. Production of aluminium oxide and other aluminium compounds. 295,227.

12,073. Davies, A. Apparatus for the electro-magnetic separation of ores. 295,417.

12,934. Smith, W. S., Garnett, H. J., and Holden, J. A. Magnetic alloys. 295,443.

14,434. Wattmann, J. Mould for aluminothermal welding of rails. 295,459.

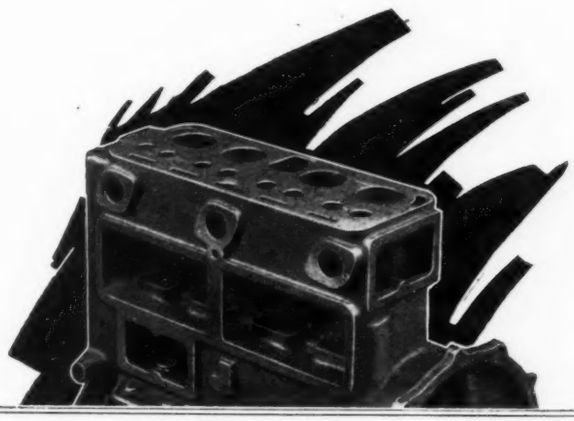
34,803. La Corsa, L. U. Method of separation of tin from tin-plated scraps or the like. 287,892.

12,144. Rotzel, C. Rolling processes for band iron. 289,878.

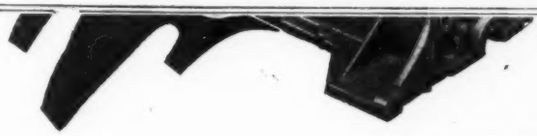
Aluminium-coated Steel Sheets.—The Eisen und Stahlwerke Hœsch A.G. at Dortmund is engaged on the construction of a new plating plant and rolling mill at Stockheide, on the Ruhr. In this new mill it is planned that aluminium, and later other metals, will be rolled on ordinary black-steel sheets by a special patented process.

Costs in Automatic Welding.—According to Mr. M. W. Brewster, the following formulæ give cost per running foot of weld:—(1) To find the electrode cost in dollars per ft. of bead, multiply the electrode feed in in. per min. by the weight of the electrode per ft. of bead and by the electrode cost in dollars per lb., and divide the running product by the travel speed in in. per min. (2) To find the cost of electrical energy in dollars per ft. of bead, multiply the kw. input to the motor-generator set by 12 times the cost of the electrical energy in dollars per kw.-hr., and divide the product by 60 times the travel speed in in. per min. (3) To find the cost of labour in dollars per ft. of bead, divide 12 times the rate in dollars per hr. by 60 times the travel speed in in. per min. (4) If hand welding instead of automatic welding were to be considered, the electrode consumption would be greater, because 15 to 20 per cent. of each length used is discarded. In automatic welding this is eliminated by a continuous wire feed from a reel. (5) The usual hourly rate for hand welders is within the range covered by the labour costs assumed above, but the welding speed of hand welders on a job to which automatic welding can successfully be applied is only one-third to one-fifth the speed of the latter.—"The Iron Age."

WHAT THE BRADLEY SERVICE MEANS TO THE FOUNDRYMAN. No. 2.



18 DIFFERENT GRADES ALWAYS IN STOCK



In every foundry, the occasion arises, at some time or other for a grade of Pig Iron to a definite analysis, to fit in some particular mixture; a Pig Iron to toughen or close the grain, to lower the Silicon or raise the Manganese. However large and varied the stocks of iron on hand, there are times when something different is needed, and it is then that the Bradley Service can be utilised to good purpose.

Bradley's carry considerable stocks of Refined Irons in upwards of 18 different grades. Every cast is carefully analysed and the composition recorded for future reference.

Deliveries from stock can usually be made the same day, and within a reasonable radius delivery by lorry can be guaranteed within 24 hours.

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PIG IRON

"A QUALITY FOR EVERY REQUIREMENT"

Write or 'phone for particulars of the Bradley range of Refined Pig Irons. Immediate attention is given to all enquiries and the knowledge and long experience of Bradley's is at the disposal of all foundrymen.

Make full use of The Bradley Service

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WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash ..	..62 8 9
Three months ..	..62 16 3
Electrolytic	..68 15 0
Tough	..65 5 0
Best selected ..	..65 5 0
Sheets	..94 0 0
India	..76 15 0
Wire bars	..69 5 0
Do. September ..	..69 5 0
Do. October ..	..69 5 0
Ingot bars	..69 5 0
H.C. Wire rods ..	..73 7 6
Off. av. cash, July ..	..62 18 4 5/24
Do. 3 mths., July ..	..63 3 9
Do., Sttlmnt., July	..62 18 3 5/12
Do., Electro, July ..	..68 18 4 10/12
Do., B.S., July ..	..66 3 7½
Aver. spot price, copper, July	62 18 4½
Do., Wire bars, July	..69 3 5
Solid drawn tubes	13½d.
Brazed tubes	13½d.
Wire	10d.

BRASS.

Solid drawn tubes	11½d.
Brazed tubes	13½d.
Rods, drawn	10½d.
Rods, extd. or rlld. ..	7½d.
Sheets to 10 w.g. ..	10½d.
Wire	9½d.
Rolled metal	9½d.
Yellow metal rods	7½d.
Do. 4 × 4 Squares ..	8d.
Do. 4 × 3 Sheets ..	8½d.

TIN.

		£ s. d.
Standard cash ..		209 12 6
Three months ..		206 15 0
English		207 10 0
Bars		210 0 0
Straits ..	(Nom.)	213 0 0
Australian ..	(Nom.)	211 5 0
Eastern		211 15 0
Banca	(Nom.)	218 0 0
Off. av. cash, July ..		212 10 11 13/24
Do., 3 mths., July		209 14 10 7/12
Do., Sttlmt., July		212 10 2 5/12
Aver. spot, July ..		212 10 11½

SPELTER.

Ordinary	..24 15 0
Remelted	..23 0 0
Hard	..19 10 0
Electro 99.9	..28 0 0
English	..24 17 6
India	..21 5 0
Zinc dust ..	(Nom.) 35 5 0
Zinc ashes	..7 15 0
Off. aver., July ..	..24 19 2 5/44
Aver., spot, July ..	..24 18 11

LEAD.

Soft foreign ppt. ..	..22 2 6
English	..23 10 0
Off. average, July ..	..20 15 5 35/44
Average spot, July ..	..20 11 11½

ZINC SHEETS, &c.

Zinc sheets, English	..33 0 0
Do. V.M. ex whf.	..31 5 0
Rods	..39 0 0
Boiler plates	..29 0 0
Battery plates	(Nom.) 30 10 0

ANTIMONY.

Special brands, Eng.	..59 0 0
Chinese	..39 10 0
Crude	..33 10 0

QUICKSILVER.

Quicksilver	..23 2 6

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	8 0 0
45/50%	12 5 0
75%	19 7 6
Ferro-vanadium—	
35/50%	..14/- lb. Va.
Ferro-molybdenum—	
70/75% c. free ..	..4/3 lb. Mo.
Ferro-titanium—	
23/25% carbonless ..	1/2 lb.
Ferro-phosphorus, 20/25%	£18 0 0
Ferro-tungsten—	
80/85%, c. fr.	1/3 lb.
Tungsten metal powder—	
98/99%	1/7 to 1/7½ lb.
Ferro-chrome—	
2/4% car.	£30 0 0
4/6% car.	£21 17 6
6/8% car.	£20 17 6
8/10% car.	£20 5 0
Ferro-chrome—	
Max. 2% car. ..	£33 2 6
Max. 1% car. ..	£38 0 0
Max. 0.70% car. ..	£34 0 0
70% carbonless ..	1/1 lb.
Nickel—99% cubes or pellets	£175 0 0
Ferro-cobalt	9/- lb.
Aluminium 98/99% ..	£95 0 0
Metallic chromium—	
96/98%	2/8 lb.
Ferro-manganese (net)—	
76/80% loose ..	£13 15 0
76/80% packed ..	£14 15 0
76/80% export ..	£13 10 0
Metallic manganese—	
94/96%, carbonless ..	1/6 lb.
Per ton unless otherwise stated.	

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0 2 3
Finished bars, 18% tungsten	£0 2 9
Per lb. net, d/d buyers' works.	
Extras—	
Rounds and squares, 3 in. and over..	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 1/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅛ in.	3d. lb.
Do., under ¼ in. × ⅛ in. ..	1/- lb.
Bevels of approved sizes and sections	6d. lb.
Bars cut to length, 10% extra.	
Scrap from high-speed tool steel—	
Scrap pieces	3d.
Turnings and swarf ..	1d.
Per lb. net, d/d steel makers' works.	

SCRAP.

	£ s. d.
South Wales—	
Hvy. steel	3 8 0
Bundled steel and shrngs. ..	3 2 6 to 3 6 6
Mixed iron and steel ..	3 0 0 to 3 2 0
Heavy cast iron	2 15 0 to 2 16 6
Good machinery for foundries	3 2 6
Cleveland—	
Heavy steel	2 15 0
Steel turnings	2 7 6
Cast iron borings ..	2 4 0
Heavy forge	3 10 0
Bushelled scrap	3 0 0
Cast-iron scrap	3 2 6
Lancashire—	
Cast-iron scrap	3 0 0
Hvy. wrought	2 17 6
Steel turnings	2 2 6
London—Merchants' buying prices delivered yard.	
Copper (clean)	52 0 0
Brass	37 0 0
Lead (less usual draft) ..	18 0 0
Tea lead	16 0 0
Zinc	15 0 0
New aluminium cuttings..	66 0 0
Braziery copper	47 0 0
Gunmetal	47 0 0
Hollow pewter	150 0 0
Shaped black pewter ..	105 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	68/6
Foundry No. 3	66/-
Foundry No. 4	65/-
Forge No. 4	64/6
Hematite No. 1	70/6
Hematite M/Nos.	70/-
N.W. Coast—	
Hem. M/Nos. d/d Glas. ..	79/-
,, d/d Birm.	86/-
Midlands—	
Staffs. common*	67/6
,, No. 4 forge ..	56/-
,, No. 3 fdry... ..	60/-
Shrops. basic	—
,, Cold blast, ord.* ..	—
,, ,, roll iron* ..	—
* d/d Birmingham.	
Northants forge	51/6
,, fdry. No. 3 ..	55/-
Derbyshire forge	59/-
,, fdry. No. 3 ..	59/6
,, basic	60/-
Scotland—	
Foundry No. 1	76/-
,, No. 3	70/6
Hem. M/Nos.	74/-
Sheffield (d/d district)—	
Derby forge	61/6
,, fdry. No. 3 ..	64/-
Lincs. forge	62/6
,, fdry. No. 3 ..	64/-
E.C. hematite	78/6
W.C. hematite	84/-
Lincs. (at furnaces)—	
Forge No. 4	58/-
Foundry No. 3	59/6
Basic	—
Lancashire (d/d eq. Man.)—	
Derby forge	—
,, fdry. No. 3 ..	67/6
Northants foundry No. 3..	—
Dalzell, No. 3(special)	100/- to 102/6
Summerlee, No. 3 ..	87/6
Glengarnock, No. 3 ..	87/6
Gartsherrie, No. 3 ..	87/6
Monkland, No. 3 ..	87/6
Shotts, No. 3	87/6

FINISHED IRON AND STEEL.

Usual District deliveries for iron ; delivered consumers' station for steel.

Iron—	£ s. d.	£ s. d.
Bars (cr.) nom.	9 10 0 to 10 15 0	
Nut and bolt iron	8 12 6 to 8 17 6	
Hoops	11 10 0	
Marked bars (Staffs.) f.o.t.	12 0 0	
Gas strip	11 10 0	
Bolts and nuts, ¾ in. × 4 in.	15 5 0	
Steel—		
Ship plates..	8 7 6 to 8 12 6	
Boiler plts...	10 10 0	
Chequer plts.	10 12 6	
Angles	7 17 6	
Tees	8 17 6	
Joists	7 17 6	
Rounds and squares, 3 in. to 5½ in.	8 17 6	
Rounds under 3 in. to ⅜ in. (Untested)	7 15 0 and upwards	
Flats, over 5 in. wide and up	8 7 6	
Flats, 5 in. to 1½ in. ..	7 17 6	
Rails, heavy	8 10 0	
Fishplates	12 10 0	
Hoops (Staffs.)	10 0 0	
Black sheets, 24g. ..	10 0 0	
Galv. cor. shts., 24g. ..	13 10 0	
Galv. fencing wire 8g. plain	12 10 0	
Billets, soft	6 0 0 to 6 10 0	
Billets, hard	7 2 6 to 7 12 6	
Sheet bars	6 0 0	
Tin bars	6 0 0	

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	1 2½
Sheet to 10 w.g.	1 3
Wire	1 3½
Rods	1 3
Tubes	1 7½
Castings	1 2

Delivery 3 cwt. free.
10% phos. cop. £40 above B.S.
15% phos. cop. £50 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	per lb.
Ingots for raising ..	9d. to 1/3
Rolled—	
To 9 in. wide ..	1/3 to 1/9
To 12 in. wide ..	1/3½ to 1/9½
To 15 in. wide ..	1/3½ to 1/9½
To 18 in. wide ..	1/4 to 1/10
To 21 in. wide ..	1/4½ to 1/10½
To 25 in. wide ..	1/5 to 1/11
Ingots for spoons and forks	9d. to 1/5½
Ingots rolled to spoon size	1/- to 1/8½
Wire round—	
3/0 to 10 G.	1/6½ to 2/1½
with extras according to gauge.	

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2X foundry, Phila. ..	20.26
No. 2 foundry, Valley	16.50
No. 2 foundry, Birm.	15.50
Basic	17.76
Bessemer	18.76
Malleable	18.76
Grey forge	18.01
Ferro-mang. 80% d/d	105.00
O.-h. rails, h'y at mill	43.00
Bess billets	32.00
O.-h. billets	32.00
O.-h. sheet bars	32.00
Wire rods	42.00
	Cents.
Iron bars, Phila.	2.12
Steel bars	1.90
Tank plates	1.90
Beams, etc.	1.90
Skelp, grooved steel	1.90
Skelp, sheared steel	1.90
Steel hoops	2.20
Sheets, black, No. 24	2.65
Sheets, galv., No. 24	3.40
Sheets, blue an'l'd., 9 and 10 ..	2.00
Wire nails	2.55
Plain wire	2.40
Barbed wire, galv.	3.20
Tinplates, 100 lb. box	$5.25

COKE (at ovens).

Welsh foundry	27/- to 50/-
,, furnace	20/- to 21/-
Durham and North.	
,, foundry	14/- to 14/6
,, furnace	14/-
Other Districts, foundry ..	—
,, ,, furnace (basis) ..	12/-

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. Cokes ..	20×14 box	18/- to 18/3
,, ..	28×20 ,, ..	36/3
,, ..	20×10 ,, ..	27/-
,, ..	18½×14 ,, ..	18/9
C.W. ..	20×14 ,, ..	17/-
,, ...	28×20 ,, ..	34/-
,, ...	20×10 ,, ..	22/-
,, ...	18½×14 ,, ..	15/6
Terneplates ..	28×20	33/6 per box basis f.o.b.

SWEDISH IRON.

Bars, hammered, £17 10 0 to £18 10 0	
Rolled Ord. ..£15 0 0 to £15 10 0	
Nail rods .. £15 7 6 to £15 15 0	
Keg. steel nom. ..	..£33 to £35
Faggot steel nom. ..	£22 to £25
Blooms, according to quality	£8 to £12
Pig-iron .. £5 15 0 to £6 0 0	

All f.o.b. Gothenburg.

TUBES AND FITTINGS.
Up to and incl. 6 in.

	Tubes.	Fittings.
Gas	67½%	50%
Water	63¾%	45%
Steam	60%	40%

W.I. 10% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

	£ s. d.	
Aug. 23 ..	62 11 3	inc. 3/9
,, 24 ..	62 12 6	,, 1/3
,, 27 ..	62 12 6	No change
,, 28 ..	62 11 3	dec. 1/3
,, 29 ..	62 8 9	dec. 2/6

Electrolytic Copper.

	£ s. d.	
Aug. 23 ..	68 15 0	No change
,, 24 ..	68 15 0	,, ,,
,, 27 ..	68 15 0	,, ,,
,, 28 ..	68 15 0	,, ,,
,, 29 ..	68 15 0	,, ,,

Standard Tin (cash).

	£ s. d.	
Aug. 23 ..	212 10 0	inc. 20/-
,, 24 ..	211 0 0	dec. 30/-
,, 27 ..	208 15 0	,, 45/-
,, 28 ..	210 0 0	inc. 25/-
,, 29 ..	209 12 6	dec. 7/6

Tin (English ingots).

	£ s. d.	
Aug. 23 ..	210 10 0	dec. 10/-
,, 24 ..	209 0 0	,, 30/-
,, 27 ..	206 15 0	,, 45/-
,, 28 ..	208 0 0	inc. 25/-
,, 29 ..	207 10 0	dec. 10/-

Zinc Sheets (English)

	£ s. d.	
Aug. 23 ..	33 0 0	No change
,, 24 ..	33 0 0	,, ,,
,, 27 ..	33 0 0	,, ,,
,, 28 ..	33 0 0	,, ,,
,, 29 ..	33 0 0	,, ,,

Spelter (ordinary).

	£ s. d.	
Aug. 23 ..	24 10 0	inc. 3/9
,, 24 ..	24 8 9	dec. 1/3
,, 27 ..	24 10 0	inc. 1/3
,, 28 ..	24 12 6	,, 2/6
,, 29 ..	24 15 0	inc. 2/6

Lead (English).

	£ s. d.	
Aug. 23 ..	23 5 0	No change
,, 24 ..	23 5 0	,, ,,
,, 27 ..	23 5 0	,, ,,
,, 28 ..	23 5 0	,, ,,
,, 29 ..	23 10 0	inc. 5/-

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Yearly Average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1887	37 5	35 10	34 4	34 4	34 1	34 10	34 4	34 5	33 9	31 10	31 8	33 6	34 2
1888	32 2	31 1	31 5	31 9	30 11	31 5	32 4	33 5	34 8	34 2	33 11	33 10	32 7
1889	33 8	35 0	37 5	38 9	38 6	37 10	40 1	43 4	44 1	51 5	64 7	61 1	43 10
1890	60 3	53 1	51 0	47 4	42 2	41 5	43 2	45 7	47 9	47 10	47 4	43 1	47 6
1891	42 1	41 10	39 9	38 7	40 9	41 0	40 8	39 8	40 4	39 11	38 8	38 1	40 1
1892	37 7	35 7	36 10	37 10	39 2	40 11	39 11	39 10	40 0	38 6	37 6	37 4	38 5
1893	36 0	34 3	34 4	34 2	33 10	34 8	35 3	35 5	35 4	34 8	34 7	35 9	34 10
1894	35 8	35 11	36 1	36 1	35 5	35 5	35 5	35 11	36 6	35 8	35 8	35 1	35 9
1895	34 7	34 4	34 4	34 8	35 6	35 2	36 1	37 1	38 10	38 6	37 11	37 6	36 3
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 8	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 8	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	56 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 3½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7½
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	9 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	66 10½	65 0	73 2½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	—	—	—	—	65 4½

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PIG IRON

REGISTERED TRADE MARK

SCOTCH, MIDDLESBRO', HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

FOUNDRY FOREMAN wanted, age 30-35, for modern Foundry, about end of September; only those need apply who have had experience with repetition work up to one ton; personal application preferred.—Higgs Motors, Witton, Birmingham.

ASSISTANT MANAGER or FOREMAN MOULDER requires position; steel preferred; wide and varied experience in latest methods of production on all classes work; convertor, electric, Siemens Martin, and cupola practice, oil sand practice, conversant in metallurgy; good references; age 43; member of the Institute of British Foundrymen; similar positions held since 1912.—Box 796, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

PATENTS AND TRADE MARKS.

INFORMATION HANDBOOKS, Advice, and Cons. free; King's Patent Agency, Ltd.—B. T. King, C.I.M.E. (Regd. Pat. Agent, G.B., U.S.A., and Can.), 146a, Queen Victoria Street, E.C.4. 40 years' refs. 'Phone: 0682 Central.

PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. The new 1928 edition is now on sale. Price 42s. net, bound in cloth.—Published by Industrial Newspapers, Ltd., 49, Wellington Street, Strand, London, W.C.2.

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Will Sell whole or in lots to suit customers, or Let on favourable terms. Unique opportunity for Manufacturers.

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SAND MIXERS AND CORE-MAKING MACHINES.—Ask for our quotation for new Machines; prices from £14 upwards. Write for List.

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CLOISTER WORKS,
CONGRESS STREET, SHEFFIELD.

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DIAMOND Surface Grinding Machine, with magnetic chuck 2 ft. 8 in. x 10 in.

Vertical Rotary Surface and Ring Grinding Machine, with 12-in. dia. magnetic chuck.

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One good second-hand BABCOCK WATER TUBE BOILER of 4,356 ft. of heating surface, reinsurable at a working pressure of 150 lbs. per sq. in., with chain grate stoker, etc.

VERTICAL BOILER, 14 ft. 6 in. high x 5 ft. 1 in., reinsure 70 lbs. pressure.

18,000 ft. of NEW 2-in. dia. Screwed and Socketed Piping, in lengths of about 18/21 ft. to British Standard Specifications and tested to 270 lbs. hydraulic pressure.

Portable "Stothert & Pitt" Petrol-driven Concrete Mixer, about 7-cub. ft. capacity, auto. loading hopper, 5-b.h.p. engine.

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THOS. W. WARD LTD., ALBION WORKS, SHEFFIELD.

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GANISTER, best quality, for Cupolas, also for Steel Works.—Astbury Silica Company, "The Brooms," Park Lane, Congleton.

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CLOISTER WORKS,
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CARBEST POCKET MICROSCOPE, magnifies 25 times, Fountain Pen size, Cellulose finish, price 6s. 6d. each. Write to-day for yours. All Chemists should possess our Carbest List.

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Normanby Brickworks, Normanby, Eston, Yorks.

'Phone: 287 SLOUGH.

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150 lb. MORGAN Cokefired "S" type ..	£40
250 lb. MORGAN Cokefired "S" type ..	£48
400 lb. MORGAN Oilfired, NEW	£80
600 lb. MORGAN Cokefired "A" type ..	£85
800 lb. MORGAN Cokefired "A" type ..	£90

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EVERY SIZE LADLE (1 cwt. to 15 ton) in Stock

LARGEST STOCK OF FOUNDRY PLANT IN ENGLAND. PLEASE SEND FOR LISTS

BUY FROM ME AND SAVE MONEY.

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